

# The Boston Medical and Surgical Journal

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## Original Articles.

### ACIDOSIS: A SUMMARY OF RECENT KNOWLEDGE.\*

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[From the Department of Medicine, University of California.]

It is known by the researches of the last two or three years that acidosis is an extremely common condition. As a physiological and beneficent reflex, it occurs after violent exercise and from exposure to an atmosphere of low oxygen tension, as on mountain-tops. But it is also found as a more or less noxious complication in a number of diseases. Those forms where the acids involved belong to the ketone group have long been recognized: in diabetes, in starvation, after surgical operations, in cyclic vomiting, diarrhea, and certain infections of childhood. Much more recently it has been shown that this condition also occurs in nephritis, and other diseases of the kidney, in decompensated heart lesions, in pneumonia, in asphyxia, as from gas poisoning, in anemia, and in pregnancy. The researches which have established these facts have for the most part not yet appeared in any text-book.

#### DEFINITION OF ACIDOSIS.

Acidosis may be defined as an increase above normal of any of the acid elements of the blood. This does not necessarily mean that the reaction

\* Read at a meeting of the University Hospital Medical Society, San Francisco, Sept. 7, 1916.

of the blood as a whole is appreciably altered. An increase in the acid phosphate or in the organic acids of the blood will be up to a certain point promptly and completely compensated by a loss of the carbonic acid complement, so that the chemical reaction of the blood as a whole remains normal, or so nearly so that the difference cannot be measured. This compensation takes place through respiration. The action of the respiratory center is governed by the reaction of the blood, any increase in acidity causing stimulation to breathing. This, in return, washes out an increased amount of CO<sub>2</sub>, and reduces the acidity to the normal level again. The term "acidosis," then, ordinarily implies only that the non-volatile acids (usually acid phosphate or organic acids) are increased, while the acid carbonate (bicarbonate) and carbonic acid are in compensation reduced.

The reaction of the blood is usually expressed in terms of the hydrogen-ion-concentration, that is, the quantity of free acid radicals present. There is in every watery solution, or even in pure water, certain concentration of such acid ions, which can be measured by appropriate methods. Blood, having a less number than distilled water, is properly considered alkaline, so that the term "hydrogen-ion-concentration" as applied to the condition of the blood is preferable to that of "acidity," though the latter would hardly be a misnomer.

#### PHYSIOLOGY OF ACID REGULATION.

To understand the nature of acidosis, we must know the physiology of the maintenance of a constant chemical reaction in the body. First,

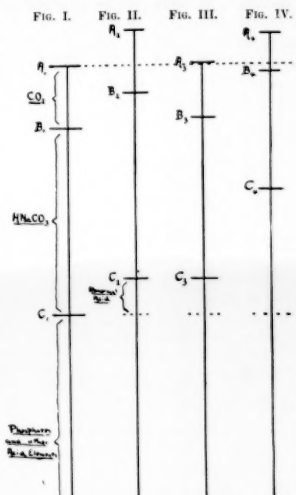
the blood, and in fact the whole mass of body tissue, must be studied from this point of view. Second, the respiration, as the ready and quickly acting means of adjustment to any change. Third, the kidney also participates, much more slowly, by keeping the salts and non-volatile acids of the blood at a singularly constant level.

The physical chemistry of the blood as a medium for adjustment of chemical reaction has been worked out by L. J. Henderson<sup>1</sup> and his associates in an admirable series of articles. The blood is to be conceived of, in accordance with the modern theories of ionization, as a beautifully balanced complex of chemical radicals, all to a greater or lesser degree in the form of ions. The latter consist of the alkaline radicals, K, Na, Ca, Mg, other minerals in small amounts, and  $\text{NH}_4$ , and the acid radicals, chlorides, sulfates, phosphates, some other mineral acids, carbonates, carbonic acid and various organic acids, such as lactic, diacetic, etc. Of the salts which affect the reaction of the blood, those in greatest amount are the phosphates ( $\text{Na}_2\text{PO}_4$ ,  $\text{HNa}_2\text{PO}_4$ ,  $\text{H}_2\text{NaPO}_4$ ), carbonates ( $\text{Na}_2\text{CO}_3$ ,  $\text{HNaCO}_3$ ), and free carbonic acid. These bodies are so much the most important that no great error is involved in looking upon the blood as a solution of these salts alone. Henderson has shown that this mixture is such that considerable additions of acid or alkali change its ionic concentration to an extremely small extent. This is due to the low degree of ionization of the radicals present, which though un-ionized are still capable of binding a considerable number of added free ions without great change in reaction being brought about. The albumins of the blood also damp any change of reaction to a considerable extent, as Robertson<sup>2</sup> has shown. The degree of this resistance to change in reaction is sometimes referred to as the "buffer-value" of the blood. It must be remembered, however, that every addition of acid or alkali to the blood does cause some change in reaction, even though small, and this "buffer-value" represents the limits of extremely reluctant change rather than a limit within which there is no change at all.

Any addition of acid to this complex causes a shifting in the balance of all the members present: some of the alkaline phosphate becomes acid phosphate, and at the same time the carbonate becomes bicarbonate, and some of the bicarbonate loses its alkali and becomes carbonic acid. That is, the net result of this shifting all along the line is that there is, for the time being, more free  $\text{CO}_2$  dissolved in the blood. This increase of the acid elements, of course, stimulates the respiratory center, with increase in ventilation, and the extra  $\text{CO}_2$  which has been formed is almost instantly washed out through the lungs, and the H-ion concentration reduced again to the normal figure.

The mechanism may be illustrated by a dia-

gram, which, of course, must not be taken too literally as an exact representation of chemical facts. In Figure I let  $A_1B_1$  represent the dis-



solved  $\text{CO}_2$ , or the divalent  $\text{CO}_3$  ion.  $B_1C_1$  represents the bicarbonate, and the line below  $C_1$  the three phosphate radicals and all other acid substances. For a given set of conditions these quantities will be proportional according to physico-chemical laws, which are explained by Henderson. A change in one quantity will bring about a change in all. Thus, if there is added an acid, such as lactic (Fig. II) the line  $C_1$  will rise to  $C_2$ , and  $B_1$  and  $A_1$  will rise to  $B_2$  and  $A_2$  respectively. This rise of the total acid to a line above the normal, stimulates the respiratory center, and the excess of  $\text{CO}_2$  is quickly removed, bringing the line  $A_2$  back to its normal line, or so nearly so that the difference is not measurable. As the extra  $\text{CO}_2$  goes out, there is further interchange of H-ions from the phosphates toward the carbonates, and the level of B will be correspondingly shifted. Any such condition as Fig. II, therefore, would be unstable and, as a matter of fact, could hardly occur at all, since the increase of acid takes place gradually, and the excretion of  $\text{CO}_2$  would so fully keep pace with it that the line A never gets appreciably above its normal level. Figure III represents the ordinary condition in acidosis.<sup>†</sup>

At this stage the kidney begins its work, which is to keep the non-volatile ions at the constant level  $C_1$ , so that, normally, within the next hour or so, enough acid phosphate or other

<sup>†</sup> The completeness of this compensation in all but the most extreme grades of acidosis is shown by the results of Peabody,<sup>3</sup> as well as others, who, using direct electrical measurement, found a practically normal H-ion concentration in almost all cases of acidosis. Many of the writers on acidosis, however, seem to have failed to realize the completeness of this compensatory mechanism.

acid will have been excreted in the urine to bring the line  $C_3$  back to the normal threshold of  $C_1$  (assuming, of course, that the addition of acid does not continue), and at the same time A and B will return to their normal location.

The importance of this function of the kidney in maintaining the reaction of the blood has only lately been realized, as well as its rapidity and delicacy of action. The kidney has the singular power of withdrawing acid radicals from an alkaline medium and excreting them in the acid urine. The radicals thus withdrawn consist, to a large extent, of the acid phosphates, though, if the acid production of the body is low, the alkaline phosphate and even the bicarbonate will appear, and the urine may thus be alkaline. It is to be borne in mind that the kidney is not merely excreting the various salts as they come to it. It is definitely maintaining a threshold value for acids; above this threshold acid ions will be passed out; below the threshold, in similar fashion, enough alkali will be excreted to keep up to the normal. It has been found that though this level of the acid salts in the blood varies somewhat between individuals, it remains remarkably constant in the same person. Also the total acid and therefore, of course, the amount of dissolved  $\text{CO}_2$  remain constant in the same subject over many years.

The amount of alkali radical which is available to neutralize acid (i.e., the tri- and disodium phosphate and the carbonates) is sometimes referred to as the "alkali reserve." Such a value would be represented approximately by the line BC in the figure.

This represents the method of compensation for acidosis, and in the ordinary case it is fully successful in keeping A (the total H-ion concentration) practically at its normal level.

Strictly speaking, it is incorrect to say that the acid level (A) returns absolutely to the normal. A balance must be struck where the respiration is enough increased to keep the  $\text{CO}_2$  at a less concentration than usual, and this increased respiratory activity implies some increase in the H-ion concentration. But the respiratory center is so extremely sensitive that this increase is ordinarily below the limits of measurement.

Of course there is a limit to the powers of this compensatory mechanism. Figure IV represents a condition which occurs only in the most extreme forms of acidosis (usually near death), where the level of C has become so high that the most energetic breathing cannot keep the  $\text{CO}_2$  and the carbonate level below that of the normal total acid.

#### SOURCE OF THE ACID IN THE BLOOD.

A word should be said as to the source of the various radicals in the blood. Of the alkali radicals, the minerals are, of course, derived from the food in considerable excess, so that there is constant excretion in the urine. Neutral salts with stable acid radicals have little

effect on the reaction of the blood or urine, since the ions are balanced. Carbonates, however, or organic salts of alkalis which mostly break down into carbonates, add to the alkalinity of the body, since the  $\text{CO}_2$  readily leaves by the lungs, and the alkali ion is left. If acid production be above the capability of the mineral radicals to handle, a store of ammonia is utilized by a change in protein catabolism, viz: less urea

$\text{CO} - \text{NH}_2$   
 $- \text{NH}_2$  is produced, and instead, one or two less  $\text{H}_2\text{O}$  molecules are abstracted from the protein end-products, with the production of ammonium carbamate  $\text{CO} - \text{ONH}_2$  or ammonium carbonate  $\text{CO} - \text{ONH}_2$ . If all the

ammonia which can be got by proteid catabolism be utilized to neutralize acid radicals, there appears to be no further alkali asset, and the ability of the kidney to excrete acid as such is the only resource in preventing the acidosis from increasing to a fatal degree.

The acid radicals come normally to some extent from bodily catabolism, but largely from the food. Meat is the great acid producer, vegetable diet showing a considerable excess on the alkaline side. Bodily catabolism in health probably produces little acid excess, as is shown by the frequent occurrence of alkaline urine, even on a diet which contains some meat.†

Under abnormal conditions, however, there is often considerable acid production by bodily catabolism. Acid products always result from deficient oxidation. When muscles are exercised vigorously the oxygen supply may not be fully sufficient, and lactic acid is the resulting end-product, instead of  $\text{CO}_2$ , as normally. Lactic acid has actually been demonstrated in blood and urine after moderately vigorous exercise.<sup>5</sup> Similarly, there is imperfect oxygenation in the first hours at considerable altitudes (mountain sickness), and here also acidosis has been found, which at first is probably due to lactic acid.<sup>6</sup> Again, lack of carbohydrate participation in the catabolism of fats gives a considerable quantity of diacetic and B-oxybutyric acid. These acids are, therefore, found in diabetes and in starvation. The reason for the production of the same acids in the cyclic vomiting of childhood and after anesthesia is not well understood.

The teleological significance of acidosis in conditions of poor oxygen supply is evident. Deficient oxidation brings the reflex of increased respiration, with improvement in the oxygen supply. Barcroft<sup>7</sup> demonstrated that the members of a party on a mountain trip who got a prompt and considerable acidosis, were comfortable and able to do vigorous exercise, while certain others who were more or less prostrated showed much less acid in the blood.

† This was shown by the fact (not yet published) that dogs do not necessarily develop any acidosis after nephrectomy. If the acid production were great they ought, in consequence of failure of elimination, to succumb to a prompt acidosis.

Acidosis may arise in two ways, and the distinction is important: 1. By an overproduction of acid, with which the kidney is unable to keep pace. 2. By failure of the kidney to excrete the normal amount of acid, even without overproduction,—that is, a failure to maintain the threshold at its normal level. This may result from incompetence of the kidney, as in nephritis, but there is also evidence to show that a perfectly normal kidney may at times establish a new threshold value for acid, often with a physiological purpose in view.<sup>8</sup> For instance, it has been pointed out that in mountain sickness there is oxygen deficiency in the tissues, and production of lactic acid. It might be expected that one of two things would happen in the hours following ascent of a mountain,—either the lactic acid would be excreted and the acid level subside, or that the poor oxygenation would continue, with constant production of lactic acid, and a constant state of mountain sickness. As a matter of fact, the acidosis continues to increase for weeks, as was shown very definitely on the Oxford-Yale Pike's Peak expedition,<sup>9</sup> and finally becomes permanently high. But the individual soon recovers from his early indisposition, and is in excellent health. At the same time all but traces of the lactic acid disappear from blood and urine. The only way to explain this fact is to assume that the kidney has decided, for a physiological purpose, to maintain the acid threshold at a higher level than formerly.

In an acidosis of the overproduction type, the urine will, of course, show the excretion of large amounts of acid, sometimes of an identifiable variety, as diacetic or lactic, and will give the tell-tale high ammonia quotient. In the other type, however, that due to retention of acid either from kidney insufficiency or from raised threshold, the urine need show no change from normal conditions. This is the explanation of the former divergence of opinion as to the existence of acidosis in a number of conditions such as pregnancy, nephritis, pneumonia,—where blood and alveolar air analyses indicate acidosis, but the urine shows nothing.

A word should be said as to tissue acidosis as distinguished from blood acidosis. The acid is, of course, produced in the tissues and carried off in the blood, therefore there will be a gradient from tissues to blood, and, of course, a higher level in the former. On the basis of a supposed extreme degree of tissue acidosis, Martin Fischer<sup>10</sup> has built an elaborate theory, by which he seeks to explain the most diverse phenomena. While his writings are interesting and stimulating to further research, it must be said that the proof is as yet far from sufficient to warrant their acceptance as a whole.

#### DEMONSTRATION OF ACIDOSIS.

The most prominent symptom of acidosis is hyperpnea, ranging from a slight increase in

lung-ventilation to a marked air-hunger. Later there is coma, respiratory paralysis, and death. Recent researches have demonstrated rather unexpectedly that there is some acidosis present in most cases showing hyperpnea without exertion, though there are a number of other causes which can give the same effect, as nervousness, high temperature, pulmonary congestion, etc. The presence of hyperpnea may then be taken as *prima facie* evidence of acidosis, which, of course, requires further confirmation. It is possible that with the growth of knowledge on this subject we shall eventually be able to make a correct diagnosis in the majority of cases by inspection alone.

Aside from the mere observation of hyperpnea, tests for acidosis fall into three classes,—urinary and blood analyses, and respiratory data. Urinalysis is serviceable where there is increased acid excretion, and especially where the acid is identified as the group giving the ferric chlorid reaction. The increased ammonia quotient is also of value when present, but its absence by no means rules out an acidosis due to retention. Estimation of the acidity of twenty-four hour urine and of the balance between carbonates, phosphates, etc., has been carefully studied by Henderson and his associates,<sup>11</sup> but seems likely to be of scientific rather than clinical value, because of the failure of the kidney to behave normally in a considerable proportion of the acidosis cases. Sellards<sup>12</sup> proposed a method of administering bicarbonate by mouth until the urine became alkaline, that establishing what he calls alkali tolerance. Normally the urine becomes alkaline after 5-10 gms. of the salt, but in certain cases of acidosis over 100 gms. were required. This method again is chiefly useful in cases of the overproduction type, and could hardly be used in any case on a very sick patient, as there is probably great danger in raising the concentration of salts in the blood above the normal level. Further, the retention of alkali by a diseased kidney may not be wholly due to excess of acid, and need not be proportional with it.

Of respiratory data the most important is the determination of  $\text{CO}_2$  in the alveolar air, that is to say, the air at the bottom of the lungs, undiluted by outside air. This depends on the fact that the air in the alveoli of the lungs comes almost instantly into equilibrium with the gas tensions of the arterial blood.<sup>§</sup> The determination of the alveolar  $\text{CO}_2$  would, therefore, amount to the estimation of the  $\text{CO}_2$  in the blood, or the value AB in the figures. This value is, of course, low in acidosis, and is inversely proportional to its degree. Normally the  $\text{CO}_2$  tension in alveolar air and arterial blood is about 40 mm. Hg., but readings below 10 have been obtained near death from diabetic

<sup>§</sup> The tension of  $\text{CO}_2$  in the expired or the alveolar air must not be confused with total  $\text{CO}_2$  output. In most conditions of hyperpnea the percentage in the expired air is low, but as a larger amount of air is expired, the output may be normal or even increased.



coma.<sup>13</sup> Although analyses of the alveolar air have to be carried out carefully and with due respect to certain sources of error, they are reliable, and may be applied to almost any patient, and ought to be even more widely employed than they now are. Of the numerous methods used to obtain this value, none has proved so accurate and serviceable as the original one of Haldane and Priestly.<sup>14</sup>

Of the methods involving the blood, it may be said that direct analysis has been employed (by Ryyfel<sup>15</sup>) only for the estimation of lactic acid. Electrical measurement of H-ion concentration by a hydrogen electrode has been extensively employed by Sörensen,<sup>15</sup> Hasselbalch,<sup>16</sup> and in this country by Peabody,<sup>3</sup> and others. As already pointed out, this gives only the total acidity of the blood, which is practically always normal, that is, the level of A, not of B or C, which is the data desired in this connection. Moreover, the method is very difficult, rather inaccurate, and requires expensive apparatus.

A method involving dialysis and colorimetry of the dialysate proposed by Levy, Rowntree and Marriott<sup>17</sup> is theoretically open to objection, because the dialysate will not necessarily have a reaction that is proportional to that of the original blood. In the first publications of the method, the vitally important CO<sub>2</sub> content was entirely neglected, no effort being made either to keep the CO<sub>2</sub> in or to get it all out. This method, however, has led, in the hands of its originators, to some interesting results, which are apparently reliable.

Barcroft<sup>18</sup> showed that the reaction of the blood markedly affects the ability of the hemoglobin to unite with oxygen. In a more acid medium the hemoglobin will bind less oxygen. He has devised a method based on this fact, which has been widely used by English physiologists. He exposes the specimen of blood to an atmosphere of a definite oxygen tension, and then estimates the percentage saturation of the hemoglobin. In conditions of acidosis this will be low. The range of variation is wide, and the method is faultless in theory, but it is difficult and must be performed by an expert with special apparatus. By this method all the fundamental work on the acidosis of exercise<sup>19</sup> and of high altitudes<sup>20</sup> was performed, as well as the very important first demonstration of the acidosis of nephritis.<sup>21</sup>

Finally, the Van Slyke method<sup>22</sup> of estimating the total carbonates of the blood appeared only last fall, and because of its theoretical correctness, and the ease and accuracy of its accomplishment, is sure to be very widely adopted, not only for scientific, but for clinical purposes as well. It at present stands as both the easiest and the most accurate method of establishing the existence of acidosis. Blood is withdrawn from a vein, and the plasma removed. This after exposure to air of a definite CO<sub>2</sub> tension is transferred to a simple apparatus, where, after

addition of acid to break up the carbonates, a Torricellian vacuum is produced and, after shaking, the amount of CO<sub>2</sub> evolved is measured directly. According to the figure, the value AC is the one determined, and this is, of course, inversely proportional to the acidosis. The normal content of the blood, expressed as volume per cent. of CO<sub>2</sub>, is about 60 to 70. Anything below 50 suggests acidosis. We have frequently got readings well below 20.

As the line AB is a function of AC, the alveolar CO<sub>2</sub> can also be reckoned with considerable accuracy from the Van Slyke reading.

#### OCCURRENCE OF ACIDOSIS.

The conditions in which acidosis has been demonstrated may be roughly divided into general classes. First, those with over-production of acid, due to deficient oxygenation. These include severe exercise,<sup>19</sup> mountain sickness,<sup>20</sup> probably acute anemias, gas poisoning,<sup>23</sup> and other forms of asphyxia. The moderate acidosis which may develop in cases of decompensated heart lesions, or of poor circulation in general, belongs in this class, though the accompanying passive congestion of the kidney may lead to some renal insufficiency as well, and so failure to keep the acid threshold normal. Second, conditions where a primary lack of oxygen leads to a compensatory raising of the threshold for acid,—the acidosis of high altitudes,<sup>19</sup> probably of pregnancy.<sup>24</sup> Third, metabolic conditions, where abnormal acids are produced in large amount,—diabetes, starvation, post-operative toxemia, and the diarrheas and cyclic vomiting of children.<sup>25</sup> With regard to the last it may be remarked that the acid threshold in children is normally higher than in adults. Readings by the Van Slyke method as low as 45 are considered normal in children. They are also particularly subject to the development of acidosis on relatively slight provocation, as after operations, in slight infections, etc.

A fourth class includes cases where kidney insufficiency is the deciding factor. It is now recognized, since the work of Lewis, Barcroft and associates,<sup>21</sup> already abundantly confirmed by others, that acidosis is not only common in nephritis, but is almost invariable at certain stages of the severe types. A case of granular kidney recently seen in the University Hospital showed a picture perfectly typical of diabetic coma, and was considered as such until uranalysis showed no sugar, but albumin and casts. The dyspnea of nephritis usually appears in characteristic paroxysms, especially at night. It seems probable, therefore, that the ability of the kidney to handle acids fluctuates, though a fluctuation in the acid production may also occur. At any rate these periodic attacks of dyspnea seem to be the result of a temporary acidosis. Cheyne-Stokes breathing is also usually accompanied by acidosis, though the exact mechanism of its production is not as yet clear.

An intense acidosis will be found in cases of pus kidney,—in fact, the two most marked cases which I have encountered have been of this nature. A high grade of acidosis may accompany pneumonia<sup>26</sup> and be the cause of the characteristic hyperpnea. This may be considered as a case of renal insufficiency due to the intoxication, though it may later be discovered that there is merely a shift of the threshold to a higher but definitely maintained level. There is no reason to suppose that there is any great overproduction of acid. It is an interesting fact that the dyspnea in pneumonia ceases abruptly within an hour or so after the crisis—in just about the time necessary for the kidney to eliminate the excess acid and bring the threshold to its old level. It is possible that we may now be in a position to explain the notoriously high mortality of pneumonia in mountainous regions (often as much as 60 or 75%). The already existing acidosis due to altitude would make the further development of acidosis on the basis of pneumonia particularly fatal.\*

Certain other infections besides pneumonia give rise to some acidosis, especially in children. Typhoid seems to give very little in proportion to the depth of the toxemia.

#### ACIDOSIS AS A CAUSE OF DEATH.

Study of a number of cases in the University Hospital, as yet unreported, has suggested that acidosis is very frequently the immediate cause of death. In every case studied, with the exception of one patient who died within a few minutes from a large hemoptysis, there was a more or less marked terminal acidosis. Some of these were due to the pneumonia which so frequently terminates all kinds of chronic disorders. Aside from the infectious element, the poor circulation in a moribund person would result in insufficient oxygenation and the development of acid products, and the generally demoralized state of the urinary mechanism would favor retention.

An increase in the H-ion concentration of the blood causes at first a stimulation of the respiratory centre, but beyond a certain point there is depression and final paralysis. This sequence is seen in most dying people,—first a more or less marked hyperpnea or air-hunger (stage of stimulation), which eventually changes rather abruptly to the gasping and irregular “snapping” after air, which means that the depressing effect is being felt, and, as the CO<sub>2</sub> can now accumulate rapidly, this stage practically always terminates within a few minutes to an hour in respiratory paralysis and death. The limit of safety for a patient with a marked acidosis is very narrow—a very slight increase in the CO<sub>2</sub> content of his blood will carry him over the line to respiratory depression. This, per-

\* It may also be remarked that the danger of high elevation to certain heart and kidney cases perhaps also depends on acidosis. As we learn more as to exact kinds of cases which are subject to such attack it will be possible to tell patients more intelligently whether they can or cannot safely go to mountainous regions.

haps, explains the value of fresh air in the treatment of pneumonia,—not that the outside air is materially purer than that in the room, but the breeze across his face blows away his own expiration, and prevents the slight amount of re-breathing which takes place in a quiet room.<sup>27</sup> According to this theory, an electric fan blowing across a patient's face ought to accomplish the same purpose.

#### TREATMENT.

The treatment of acidosis is still very much a matter for discussion, but certain general principles are evident. No treatment is called for in the acidosis of high altitudes, anemia and probably pregnancy, since this is a beneficent reflex, intended to increase the aeration of the blood. Alkali therapy is apparently indicated in cases of overproduction of acid where the elimination is free, *i.e.*, chiefly in cases of diabetes and of cyclic vomiting. It must be remembered, however, that the acid has to be not only neutralized but excreted as well, and many a diabetic has died in coma after such efficient alkali therapy that his urine was alkaline. A free flow of urine must be maintained at all hazards. The best diuretic is water itself, and in a case of severe diabetes, care should be taken that the volume of urine be not allowed to drop with the fall in sugar. Probably a good many deaths in diabetes are due to the sudden removal from the system of the very efficient diuretic, glucose, and the failure to continue the elimination of acid by the ingestion of an amount of water at least equal to that formerly taken. Woodyatt<sup>28</sup> believes that the value of glucose in coma depends only on its diuretic action. This substance ought to have a wide usefulness in combating acidosis of all kinds, and its use, especially as a rectal drip with or without bicarbonate, has rightly been extended to the treatment of many conditions, especially after operations and in states of collapse.

When the kidneys are refusing to pass out the acid, it is doubtful if they will handle salts any better, and it would probably be safer for the present not to use alkalis in the acidosis of nephritis, pneumonia, and in terminal conditions. An alkali largely excreted in the feces might be tried, such as chalk, or bismuth subcarbonate.

In some conditions, especially nephritis, a considerable amount of acid may be eliminated by the bowel. This probably explains the relief to the dyspnea of nephritis which often follows free purgation.

On account of its acid-producing quality, meat should be avoided in the diet of a patient with acidosis.

The value of fresh air blowing across the face will probably be as great in other conditions as in pneumonia. Oxygen may be of value in some cases, though the lack of oxygen is in the tissue and usually not in the lungs. At high altitudes it ought to be useful.

Finally, it should be said that morphine ought

to be used with the greatest care in all cases of acidosis. In spite of the great relief which follows its use for the paroxysms of nephritis, theoretical considerations, as well as certain observations on patients, would seem to indicate that the drug may be highly dangerous.† The hyperpnea represents the effort of nature to keep the acid concentration of the blood below dangerous limits, and if the respiratory mechanism is depressed by morphine, the compensation may fail, and a fatal acidosis develop.

NOTE.—Between the writing and the publication of this paper a number of articles have appeared on the subject of acidosis. Of these, probably the most important is one by Marriott and Holland,<sup>29</sup> who have demonstrated in nephritis a very marked increase in the phosphates of the blood, seeming to indicate, as was suspected, that in many of these cases of the retention type the acidosis is largely due to the failure of the kidney to eliminate the acid phosphate.

† Cheyne-Stokes breathing regularly develops in many patients after even a small dose of morphine. We must regard the recurrent periods of apnea in this condition as being harmful.

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## CHRONIC CARBON MONOXIDE INHALATION AND SOME OF ITS UNTOWARD RESULTS.

By WM. J. MCGURN, M.D., BOSTON.

In all probability there is no other known chemical substance, with which a high percentage of our urban and suburban population is brought into such frequent contact, that has attracted so little attention and yet is so capable of inducing such insidious and widespread destruction of health as carbon monoxide gas.

Several years ago, while engaged in the study of family syphilis, the writer was strongly impressed with the number of obscure nervous disorders that were found to have been associated with the inhalation of either coal or illuminating gas. On investigation it was found that these gases are capable not only of producing many diseases and conditions peculiar to themselves, but also of simulating nearly every disease known to modern neuro-pathology as well as many of the so-called "idiopathic" and "functional" abnormalities.

While it is true that relatively few physicians have recognized carbon monoxide to be an important etiological factor in the development of some of the most profound nervous disorders, it is also true that a most splendid outline of the possibilities of this subtle poison is furnished by an eminent American physician. This most illuminating discussion may be found in Osler's "Modern Medicine" of 1907, and was written by Dr. David L. Edsall, now Chief of Service at the Massachusetts General Hospital. While it is true that Dr. Edsall's article is replete with facts well worthy the attention of every living physician, it is also apparently true that the subject has not been given the respect and universal consideration that it surely deserves.

On careful inquiry, the writer found but one physician (out of more than sixty interviewed) who possessed more than a fragmentary knowledge of chronic carbon monoxide poisoning and no school or public clinic where the dangers of chronic gas poisoning are taught or considered at all, and it is owing to these deplorable facts that the above comment is respectfully offered.

Referring again to the article in "Modern Medicine," the writer wishes to say that while the number of symptoms, diseases and conditions therein mentioned as results of chronic carbon monoxide poisoning are sufficient in number not only to index a small library upon the subject but also to introduce one into the realms of nearly every branch of medical science, the full story of this odorless and invisible gas remains untold; and it seems highly probable that many years will elapse before the promulgation of adequate knowledge regarding its sources and dangers will be universally disseminated.

Realizing that it would be impossible, in an article of this kind, to discuss in detail the multitude of conditions known to be produced by the prolonged inhalation of carbon monoxide, the writer will be content merely to mention a group of symptoms, diseases, and conditions with which he has had to do and, for the sake of brevity, will limit the list to those of which he has had ample opportunity of personal observation and study.

For lack of a better method the symptoms and conditions about to be mentioned will be arranged in alphabetical order and appear under two headings, namely: first, those conditions known to have been caused by carbon monoxide intoxication; and second, those which have occasionally been found associated with the inhalation of this toxic substance but remain of unproven origin.

## LIST 1.

Conditions known to have been caused by carbon monoxide intoxication:

- Abolition of the deep reflexes.
- Akinaesthesia.\*
- Anaemia.
- Angina pectoris.
- Ankle clonus.\*
- Arteriosclerosis.
- Asthma.
- Ataxic gait.†
- Babinski's sign.†
- Bronchitis, acute.
- Bronchitis, chronic.
- Burning and itching of the toes and fingers.†
- Cardiac angina.†
- Cardiac neuroses.
- Catalepsy, simulating that of dementia precox, with apparent recovery.
- Central and marginal scotomata of optic disks.\*
- Chills and fever.
- Color blindness, transitory.\*
- Combined cerebrospinal and peripheral nerve lesions and irritations.
- Constipation, chronic.
- Contractures of skeletal muscles.
- Convulsions, clonic.\*
- Cyanosis.
- Delusions, both transitory and permanent.
- Diabetes mellitus.
- Diplopia.
- Disseminated sclerosis, distinct types of (two cases reported).
- Dyspnoea.
- Engorgement of retinal vessels.\*
- Epileptoid seizures.
- Exaggeration of knee jerks and other deep reflexes.
- Excessive appetite (a very frequent but not a constant symptom).
- Fibrillary twitching of muscles.
- General weakness.
- Girdle pain.\*
- Glycosuria, sudden and prolonged, transitory.
- Hallucinations of sight (nocturnal).
- Headache (frontal, coronal, and occipital).
- Hemic murmurs (cardiac).
- Hepes labialis.
- High blood pressure (225 to 300 with return to 140).
- Hippus.

- Hyperaesthesiae.†
- Hypersensitiveness to pain.†
- Hypochondriasis (so called)
- Hysteria.
- Hysterical joints (so called).
- Hysterical paralysis (so called).
- Illusions (varied, nocturnal).
- Impairment of pupillary light reflexes.\*
- Impairment of the thermological sense.\*
- Impairment of vision (toxic amblyopia).
- Insanity.
- Insomnia.
- Intercostal neuralgia.
- Intention tremor.\*
- Irregular pupils.\*
- Itching of skin.
- Lancinating pains.†
- Languor (usually more pronounced in early morning).
- Lightning pains.†
- Localized anaesthesia.\*†
- Localized weakness.
- Loss of knee jerks and other tendon reflexes.†
- Migraine (simulating that of brain syphilis).
- Mono- and multi-muscular spasms.
- Multiple neuritis, distinct types of.
- Multiple sclerosis, distinct types of (two cases reported).
- Muscular contractures.
- Narrowing of the fields of vision.\*
- Nausea and vomiting.
- Nightmare (shouting in sleep with illusions and optical hallucinations).
- Numbness and tingling of extremities.
- Nystagmus.\*
- Oedema of optic disks.\*
- Optic disk, sectional blanching of.\*
- Optic nerve atrophy (secondary).\*
- Pain, excruciating, including every other known character of.†
- Pain in head accompanied by tenderness of scalp.
- Pain unrelieved by morphia or other heroic treatment.†
- Paresthesia (itching, tingling, formication, etc.).
- Patella clonus.\*
- Peripheral neuritis (localized).
- Polyuria.
- Pseudo angina pectoris.
- Pseudo tabes.†
- Repeated rigors without elevation of the temperature.
- Scanning speech.\*
- Shrinking and atrophy of muscles.\*†
- Skin lesions, (chronic).
- Spastic gait.\*
- Sphygmeter control, impairment and transitory loss of.\*
- Spinal irritations.
- Stereognostic sense, loss of.
- Sudden changes in temperament, irritability, etc.
- Syncope.
- Synovitis, chronic.
- Tachycardia.
- Tactile sensation, disturbances of.
- Tenderness of nerves and muscles.†
- Tinnitus aurium.
- Typhoid state, distinct.
- Thyroid enlargement.
- Unequal pupils.
- Vertigo.

\*Seen in cases of multiple sclerosis caused by chronic carbon monoxide inhalation in furnace gas.

†Seen in cases of multiple neuritis caused by chronic carbon monoxide inhalation in illuminating gas.

## LIST 2.

Conditions which have been found associated with the inhalation of carbon monoxide but remain of unproven origin.

Aphasia, transitory.

Cancer.

Cerebral Haemorrhage.

Chlorosis.

Haemoptysis (autopsy six years later revealed a moderate arteriosclerosis and carbon deposits in lungs, but no tubercular lesion).

Menière's disease (one case only)

Nephritis, chronic.

While the sources of intoxication in the above-named conditions are almost as varied as the number of cases involved, it may be worth while to mention those with which the writer has had to do, some of which may be of interest to others in making a study of industrial and hygienic conditions.

The known sources from which men, women, and children have suffered the pangs of chronic carbon monoxide poison, in the experience of the writer are: Leaky or imperfectly fitted gas appliances such as flexible gas tubes, permanent metal gas fixtures, gas stoves and gas ovens (improperly regulated), hot water heaters, gas heaters, extinguished pilot jets, and leaky gas meters; also house furnaces (hot-air type) with uncemented fire-pot, house furnaces (hot-water type) faultily installed or with inadequate and improper draughts; coal stoves and ranges with leaky pipes or insufficient draughts, gasoline and kerosene automobile engines, steam-heating furnaces, in schools and other public buildings, with various types of forced draught appliances; also from railroads and factories burning soft coal, bakery ovens and leakage from gas plants and main pipings.

Obviously, the amount of gas that might escape and be inhaled from some of the above-named sources must be exceedingly small; indeed so moderate in amount that there is a tendency on the part of many casual observers to discredit the possibility of such profound toxic and paralytic symptoms being produced by such minute quantities of carbon monoxide; and it is here that the gravest danger, to the individual and to the general public, exists.

While it appears that several physicians who have had to do with *acute* carbon monoxide poisoning have expressed the opinion that "if the patient survives for one week after the exposure, complete recovery usually takes place," and while the writer has ample cause to regard this opinion as an extremely erroneous one, it is a fact that repeated inhalation of very minute quantities of carbon monoxide are far more dangerous to the future health of the individual than one exposure where the patient is rendered fully unconscious.

Several hypotheses have been advanced regarding the rôle played by carbon monoxide in combination with blood elements; and while a number of articles have recently appeared that would tend to place discredit upon some of the older observations that have long been accepted as conclusive, it is highly probable that carbon monoxide does unite in a more or less fixed combination with the haemoglobin of the red blood cells.

The opinion has recently been advanced in a journal of good standing that carbon monoxide is not an actual poison, but acts *solely by asphyxiation* in producing anaemia of the brain and nerve centers with the result that functional disturbances and structural lesions sometimes follow; and an attempt was made by its author to substantiate his theory with test-tube "proof." It would seem that adherence to the sphere of common sense, together with our knowledge of other asphyxiating agents, to say nothing of the facts already proven by many independent observers, should render this theory, bolstered up by observations on blood under conditions not at all similar to those of its natural existence, unworthy of serious consideration.

After prolonged clinical observations on the behavior of many cases of chronic carbon monoxide intoxication (a report on thirty-one cases will follow), the results of which are fully consistent with our knowledge of carbon monoxide haemoglobin as observed with the spectroscope, the writer wishes to express the opinion that CO is a chemical substance capable of a peculiar selective affinity; that it enters into a more or less fixed combination with the haemoglobin of undiluted blood and yet possesses a stronger avidity for certain nerve elements that are not found in other structures of the body; also that when carbon monoxide pervades the general circulation it is *slowly liberated* from its haemoglobin combination and reabsorbed by receptive brain and nerve tissues so that irritative and permanent degenerative changes often result; and that when such irritations and degenerations of the central or peripheral nervous systems are once established, an infinitely small quantity of this gas (one part to two hundred thousand) is capable of aggravating and hastening the retrogressive changes which it has already produced.

In support of the above opinion there is ample and undeniable proof that carbon monoxide, when inhaled in quantities entirely too small to interfere materially with the amount of oxygen carried by the blood, does often produce profound degenerative changes in the central and peripheral nervous systems as above mentioned; also that new signs and symptoms of these changes often continue to appear for weeks after the removal of the patient from all sources of intoxication, and that evidence of its complete elimination from the body is finally recognized in marked improvement of the general health



and in the disappearance of hemic and functional murmurs under proper hygienic environment.

At present (October, 1916) the diagnosis of chronic carbon monoxide poisoning depends upon a definite history or actual knowledge of repeated or prolonged exposures, together with the finding of a group of nerve symptoms compatible with the lesions that it is known to produce, and finally upon excluding the possibility of the said conditions being due to disease or other toxic agent. In chronic poisoning the spectroscope does not show the presence of CO in the blood unless the patient is asphyxiated from an added acute exposure.

The differential diagnosis of chronic carbon monoxide poisoning is chiefly against lead, alcohol, tobacco, arsenic, carbon bisulphide and syphilis. The first four can be excluded by the history, clinical picture, and progress of the case, together with chemical analysis of the blood and urine. The fifth may be excluded by the history and occupation of the patient, while the sixth, syphilis, where a history of an exposure to either is unobtainable, is the most difficult of all to exclude. In such cases the clinician should remember that in carbon monoxide poisoning the subjective symptoms usually outnumber the physical signs, and while the signs of structural changes are often similar to those produced by syphilis they are never quite typical of that disease; also that the signs and symptoms produced by carbon monoxide do not respond to potassium iodide or to any other known medication. In syphilis we have the blood, spinal fluid, and luetin tests, also the time-honored therapeutic test, all of which are of great value in reaching a definite conclusion.

A most perplexing problem is occasionally met with in cases where one condition overlaps the other, the greatest difficulty being to determine which is the chief offender. The question very properly arises as to whether some persons are much more susceptible to carbon monoxide than others. It is safe to state positively that this question can be answered in the affirmative. There are a number of instances in the experience of the writer where a group of four or five persons were exposed under seemingly like conditions with the result that but one out of the party suffered severe, permanent results, while the others escaped with but slight untoward symptoms.

Probably the only efficient treatment of chronic carbon monoxide poisoning will be found in the future development of preventive medicine, while the principal armamentarium will be: 1st—Education of the public to a realization of its dangers. 2d—Rigid inspection of public buildings by men highly proficient in the study of hygiene and toxicology. 3d—More rigid smoke and fuel laws with enforcement of the same. 4th—The abolition of all flexible gas fixtures, forced draught appliances, faulty chim-

ney draughts, basement openings into cold-air shafts connected with hot-air furnaces, and finally, a legal responsibility on the part of contractors for the proper installation of house furnaces and gas fixtures; also the compulsion of property owners to keep all permanent fixtures in occupied tenement houses in a reasonably safe condition.

No doubt the question of greatest importance to those already afflicted is the prognosis, about which there is much uncertainty, but the writer feels that if a diagnosis can be made from the history and subjective symptoms before definite physical signs appear, immediate removal of the patient from all sources of intoxication to a place of better hygienic conditions will finally\* result in recovery, but in cases where definite signs or objective symptoms have made their appearance, it is very doubtful if anything like complete recovery ever takes place.

## THE EPIDEMIOLOGY OF ANTERIOR POLIOMYELITIS EPIDEMICA, 1916.

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THE following facts are warranted as proving the epidemiology of this disease, being based not alone on the study of 85 reported cases in this city, but upon the neighborhood and house infections for the past two years. During that period I have seen not only all individuals in all houses where any communicable disease or suspected case has existed, but through my system of obtaining examination of a large part of school absentees, I have come in contact with practically all neighborhood illnesses.

In March, 1915,<sup>1</sup> I stated as follows: "At this time true influenza is appearing, manifested in the children that we have seen, mostly as a unilateral tonsillitis, spreading through the members of the family. Less in number are those with central nervous system signs and symptoms. It is of importance to control these to prevent later epidemic incidence, of importance to differentiate them from diphtheria and scarlet fever." In February, 1916,<sup>2</sup> I showed that not true influenza, but a streptococcal "grip" had been and was epidemic, there being numerous cases of such reported as scarlet fever and diphtheria.<sup>3</sup>

Since then I have shown<sup>4</sup> that anterior poliomyelitis was present in this vicinity in two types. The one characterized as a general infection was similar to that prevailing in New York City and in near by towns in this vicinity where I was called in consultation. The following are facts:—

\*Usually from three to twenty months are required.

1. Typical abortive cases of poliomyelitis were the streptococcal grip type of the spring, were present in frequently the same family as then affected, but in individuals who were not affected at that time. Other individuals of the family gave the more recent history of malaria, sore throats or bronchitis, and showed an eye strabismus or a recent throat or muscle weakness. In some instances, carriers in the family were demonstrable, mostly the nasal type as described in my article on Streptococcal Infection Simulating Diphtheria.

2. Typical cases of the disease as to onset, symptoms and signs were classical pictures of "Influenza." Atypical and suspected cases were like the spring grips save the more frequent irritative pressure signs of fluid on the brain, pons or cord, especially during a short period during and following the extreme humidity.

3. The convalescence of all abortive, mild or suspected cases has been very typically "Influenza or Grippe."

4. Although I have obtained but one spinal fluid in an abortive case showing a fine diplo-streptococcus, the blood picture of leucocytosis and high polymorphonuclear differential count is in accord with such an etiology.

5. The quick reparative response not only in non-crippling apparent paralyses, but those apparently crippled as well, is not in accordance with similar lesions in the sporadic cases of this year or previous years.

6. Of several thousand children coming from New York City and vicinity during the two months following July 10, 1916, in but one family did I find a carrier. That one was in a family who brought a case of poliomyelitis with them. The greater proportion of local cases had family, house or neighborhood immediately or more remotely previous infection to explain the infection of the reported case. This was true in several remote country places where, voluntarily quarantined for four and five weeks, the source of the infection had been unknown.

7. Since the middle of September there has been but one case of poliomyelitis reported, that of an adult infected in a neighboring city. Yet, since that time there have been three typhoids, four scarlet fevers and six diphtherias—all in children of ten and under, where the onset, signs, symptoms and course were in no wise different from the poliomyelitis of the summer, with the exception that there were no paralytic manifestations. One of these so-called typhoids was especially characteristic in the fear of being handled. The family history, the family or house carriers, when found, were streptococcal grips. Among some 300 absentees from school during the past one and one half months, I have seen 42 cases of grip, 3 of whom in one neighborhood showing an infective jaundice as well.

#### CONCLUSION.

The epidemiology of "Anterior Poliomyelitis Epidemica, 1916," shows this disease to have been an integral part of a streptococcal grip, prevalent in 1915, epidemic in 1916. This grip has been most protean in its manifestations.

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### Industrial Health Insurance.

#### MEDICAL SERVICES AND MEDICAL AND HOSPITAL FEES UNDER WORKMEN'S COMPENSATION.

By FRANCIS D. DONOGHUE, M.D., BOSTON,

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THERE is a principle in socio-economics known as the economy of human energy. In its broadest sense this term applies to the science of co-ordinating all the forces of production and distribution in such manner that all forms of waste will be reduced to the very lowest terms possible, and the potential forces, human and material, will be developed with the greatest efficiency. The result to be accomplished is the raising of the sum total of human happiness morally, physically, and economically to as high a degree as possible and in such manner as to make the distribution conform to the best rules of altruistic justice. The principles in this theory touch upon all forms of human activity, but will be generally applied to the entire social organism only through a long process of education, or to a considerable degree, perhaps, through the effect of some great awakening, such as the problems which have been brought to light by the present terrible but educative European war. Already signs are apparent that there has been a quickening of the public conscience to the many chances for improvement in our economic structure, and this in itself is an extremely important step in the right direction.

The subject of industrial injuries is small compared with the entire solution of all national and international problems, but is, however, of vast consequence as one of the interdependent problems of the principle of economizing human energy. Industrial injuries, properly viewed, form part of the cost of production and distribution and are a burden upon the employee, the employer, and all persons combined. A compensation act narrowly viewed has to do with the payment of money to these employees and to the

payment for certain medical expenses which must be taken care of in some manner. This in itself is a big improvement over the old system, but why stop there when there is presented the opportunity for accomplishing results permanent in value?

In dealing with the workmen's compensation act or acts we are dealing with compensation for the injured employee, in which an attempt has been made to eliminate the source of waste which came from lawyers and litigation; and the question arises whether this should not apply equally to the medical profession. Considering the subject from the standpoint that compensation means adequate medical treatment and rehabilitation, with money payments as a stop-gap while the treatment and rehabilitation are going on, the medical aspects of compensation have not yet been fully developed either to their greatest extent or to their maximum efficiency.

While our experiences with this form of conservation have been limited in time, through the intensive study which has come from the opportunity to consider large numbers of cases more or less under one central supervision, certain essential facts have clearly demonstrated themselves. If the amount of money that industry is called upon to pay were to be handled and distributed in the old way, where the employer insured himself against lawsuit and where the injured employee settled his case on the most favorable terms that he could make with very little reference to the accident or duration of his disability, industry might well look askance at further development in the compensation field.

The curtailment of emigration, due to the war in Europe, and the increased demand for workmen, brought about by our unexampled industrial activity, have led to a readjustment of industrial vision, so that the value of the man to the community and to the industry appears in a different light than heretofore.

What I have to say is not based upon any philanthropic or socialistic theory, but is a matter of applied common sense to the medical problem. In view of Mr. Williams' paper, I will start by saying that any compensation scheme which does not make medical provision for the preservation and care of the workmen from the medical standpoint is a joke.

Adequate medical service must be a leading feature of workmen's compensation, if not the most important feature of compensation for the living workman. In return for the waiting period, generally provided in compensation laws where no monetary consideration is paid, provision is made for medical and hospital services and medicines when required.

That the injured workman has accepted any waiting period would seem to imply that he is willing to forego some of his rights if the seriousness of his accident can be minimized and his period of disability shortened.

Since most cases in Massachusetts, as in other States, do not last long enough to be paid com-

pensation in the form of money, we should scrutinize carefully any substitute for the best medical services that it is possible to offer. Further than this, with the administration of various laws, a better correlated system of treatment than the ones in vogue hitherto may be developed.

A completely efficient hospital for the proper care, treatment, re-education, and readjustment by personal study of an injured employee has yet to be constructed and maintained. The charitable idea underlying the establishment of hospitals still prevails, and the appeal to the heart is much stronger in the case of the crippled child than it is in the case of the crippled adult, even though he has depending upon him a number of children who may become crippled by reason of lack of nutrition or the invasion of disease if the breadwinner of the family is partly or totally disabled from work for a considerable period.

An appointment on the medical or surgical staff in a general hospital is a big asset to the man appointed. The medical profession itself is not at all deceived by what is given and what is received by men on hospital staffs, and the reason hospital progress has been so slow is because hospitals as a rule are run by laymen who have neither the knowledge, experience, nor the desire to exact that "strict accountability" from the staff members treating the ordinary run of cases that they would exact if the patient treated was one of their own family. Many a hospital trustee, eminent in altruistic effort and burning with zeal for uplift, is too proud to fight for an injured workman.

There is a general feeling in the medical profession that general hospitals should not care for a person able to pay for private service, and they feel that an insured person comes within that category. The public, up to a comparatively recent time, were afraid of hospitals, and were encouraged to remain away from them until compelled by necessity to go. The development of the modern hospital, with the elaborate and complicated methods of diagnosis and treatment, have become competitors for public favor. They are still in a state of evolution. The advanced type of hospital has operating physicians and surgeons who are paid for full-time work which they perform in connection with the medical teaching at some institution. There is the type of hospital in which the experience and prestige serves in lieu of other direct rewards and in which no man unless of the staff is permitted to treat patients. There is another type presented where there is a regular staff, but to which outside doctors not on the staff are permitted to send patients and perform their own operations. Then there is the private hospital under private contract.

I am inclined to believe, with Dr. E. A. Codman, Boston, whose studies of hospital efficiency are second to none, "that the time has come when hospitals should advertise the ability of

their staffs by printing truthful reports which they have obtained of cases, and this should also be true of medical as well as surgical work," and not by the presentation of only favorable results. Compare the reported results of bone-planting with what we see as results.

Constant supervision and treatment may partake too strongly of paternalism, but it is the paramount duty of the industrial accident boards to insist upon methods of persistent precision. It is important to remember that the weakened points in our whole scheme of medical care have as much importance upon final results as the most elaborate details of special treatment bring for a short time even under the most favorable conditions.

If it were possible every injured workman should be kept under medical supervision from the time he was injured until able to resume his work. Such supervision should not, and need not be of the type as to be unduly expensive, and if properly carried out would save much time to the worker as well as to the employer of labor. It would have the additional advantage that the injured man would be in contact with encouragement and sympathetic treatment; when left to his own devices he might not make his best effort or he might not make his best effort at the opportune time. Early return to work is greatly helped by the assurance given by the doctor that it is safe. That does not mean within two weeks or thirty days, but it means at the time he is able to make an effort.

The loosening up and increasing flexibility of injured members could be aided by proper treatment. Even after return to work a man should be provided the opportunity to drop in and see a doctor if the work seems too hard or increases his pain. The man will stick it out better if the doctor in whom he has confidence advises him of the significance of pain, or perhaps the doctor might indicate means of relieving his discomfort while the man still remains at work. Intelligent handling of injuries requires a great deal of skill and experience not only in regard to the specific trouble under observation but the treatment of the man as a physical whole and the man as a unit in the scheme of employment.

Care and judgment are not so much needed in regard to the first treatment, which can be and is more or less standardized, as in the later handling of the case. It is evident, for instance, that with a fracture of the lower leg, for a certain period of time hospital care is required. Hospital care is good, but the minute the man is able to get from his bed to crutches, more careful supervision is required than when he is under the direct care which comes from hospital discipline. The orthopedist must complement the surgeon.

Treatment should not be attempted in a routine manner, because the necessary treatment is impossible to estimate accurately by ordinary clinical examination. For instance, an acutely

irritated back should not be irritated further by additional massage and exercise, but rest is needed first, followed later, after acute symptoms have begun to abate, by other forms of treatment, to reinforce weakened muscles or to change weight-bearing balance. Backs can be baked too long and frequently so as to become harmfully hypersensitive to heat. They may be massaged too often and vigorously, or they may be protected too continuously and to such a degree that weakness from disuse increases.

In many cases it is necessary for patients to receive both local and general treatment. While substantially all require some local form of treatment or protection to the injured part, cure is often retarded by the lack of proper hygienic regulations or surroundings. While every form of joint or back injury requires some local form of protection, massage, or baking, they all are entitled to have their recovery hastened by simple hygiene regulations which are known to be beneficial.

Unless some amount of compensation is paid before the twenty-first or even the seventeenth day, as it will be in Massachusetts after January 1, 1917, I am convinced that clinics for industrial accidents would procure better results if in addition to the medical and surgical treatment offered to the man he should be fed at the same time and place that he received his treatment. If this were done we might feel sure that he would have at least one meal a day. At present I often have doubts that he has even that one. A 10-cent plate of soup applied to the lining membrane of the stomach will take a man further on the road to recovery than 50 cents' worth of a patented preparation applied to his knee.

Many cities of Massachusetts at the last election passed by referendum vote upon the proposition of vocational schools. One such school to be established in Lynn, one of the largest shoe-making cities in the world, will train both boys and girls to enter the shoe industry after giving a four-year course for the boys and a two-year course for the girls.

If this development of vocational schools becomes widespread, as it should, or if the present school courses are supplemented by vocational schools at night, these vocational schools might be used for the reëducation of men injured in the particular industry. Trained instructors serving outside their ordinary working hours, for the training and reëducation of injured employees, in conjunction with continuing medical treatment, will bring results.

In States which have a large urban population, with the natural congestion that must necessarily arise in cities, the development of industrial farms would afford adequate outdoor exercise for injured employees during rehabilitation. It would provide a certain amount of regular régime, with regular food and sleep, and it would take the injured or crippled employee



away from that destroyer of morals and stamina—the city saloon. The person who called the saloon the poor man's club neglected to state which end of the club was passed to the workman.

The commission appointed in Massachusetts to investigate the subject of workmen's compensation and report a bill, was headed by Hon. James A. Lowell. Mr. Joseph A. Parks was a member of the sub-committee of two of the commission which drafted the present law. The latter's services were utilized by the Commonwealth by his appointment to membership on the Accident Board.

They indicated the lines along which the new law when enacted must develop, as follows:

The controversies under the act will relate largely to the extent and duration of the injury. The successful administration of the act requires the assistance of skillful physicians and surgeons of the highest integrity. This phase of the situation has occasioned difficulty in other countries. The details of this subject must be determined by the industrial accident board as they arise in actual practice. The emphasis will be laid *not* as heretofore on the lawyer, but on the doctor. (Italics are mine.)

The medical profession of this country had very little to say about the passage of workmen's compensation laws, and the rights of the medical profession were neither carefully considered nor conserved in most of this legislation.

It is to the credit of the medical profession that they were not early upon the legislative scene asking for their pound of flesh before carrying out the broad humanitarian principles underlying workmen's compensation.

*Hospital fees.*—We have met the situation of hospital fees in Massachusetts by the establishment of a few simple fundamentals brought about by a committee representing two great medical societies in the State, working in conjunction with three medical men appointed by the industrial accident board. The basis for medical fees is as follows:

"That fees paid by the companies should not be less than the average minimum fee in the locality in which the service is rendered."

This refers to fees paid to doctors, not to contracts between doctors and the insurance companies. This took into account that many medical and surgical fee tables established by local medical societies had perhaps been based upon the average income of the so-called better classes and were not generally applicable to workingmen,—who form such a large part of the free hospital and dispensary service or who turn to fraternal organizations or hospital associations.

"That charges up to \$50 for major operations are not excessive."

This did not fix a maximum, but made possible other payments based upon circumstances.

"That service rendered by lodge physicians be paid for, provided it is not inconsistent with the rules of the order."

The status of the lodge physician is a very difficult one upon which to pass, but as the choice of lodge physicians to which a member is obliged to go is somewhat similar to the insurance company providing a man to whom the employee might be obliged to go, the committee left the matter open.

"That specialists, established and recognized by the profession as such, may receive special rates for their work, provided the case requires special skill."

In a discussion of what is reasonable hospital care, it is extremely difficult to lay down a hard and fast rule which will operate in all territories with the utmost effectiveness. In the administration of the law in Massachusetts, an effort has been made to utilize existing medical institutions as they stand without insisting upon costly duplication at the expense of the insuring companies.

The hospitals are allowed to charge the insuring companies for the care of an injured patient the same rate that they would charge to an employee of a man not insured. Perhaps that works a hardship in many instances. Perhaps better service might be obtained by paying more money, but ultimately the payments to hospitals must be based upon what they give in return.

In a general way, the payment for hospital services is based upon the rule that for the first two weeks' services \$15 per week will be allowed, provided that \$15 is not a higher rate than is charged to the uninsured employee of the public at large, and for subsequent weeks in unusual cases it is felt that some concession should be made by the hospitals, and many of them make concessions from this rate, even if the rate does not fully cover the actual cost.

Reasonable extras are allowed—a fee for the taking of X-ray plates; ambulance fee; fee for plaster-of-Paris casts; fees for special nurses, not exceeding \$4 per day; and private rooms, not exceeding \$25, when the condition of the patient or the character of the injury needs isolation.

The question of adequate fees for services rendered under the varying conditions which obtain in a State like Massachusetts, and the question whether the man is better served by doctors of the employer's choice or of his own, is still an open one. The theory that if the employer represented by the insuring company were given the choice of physicians the most skillful man would be employed has not been fully borne out by experience. On the other hand, it is for the medical profession to demonstrate that the free and untrammelled choice of physicians has not elements of weakness which will impair the full usefulness of the compensation act.

Perhaps the BOSTON MEDICAL AND SURGICAL JOURNAL in an editorial in its issue of September 21, 1916, indicates the line along which we might proceed:



"It should be remembered in considering new legislation that unrestricted choice of physicians by employees will probably result in the establishment of a State-wide fee table. Such fee tables are in effect in other States and, of course, are much below the standard of fees now being paid under the 'average minimum' approval standard of the present workmen's compensation act. It may be also that absolute free choice will tend to eliminate competition between the present 27 insurance companies and bring about the concentration of all the compensation business under one insurance company, with whom all would be required to transact business under direct State supervision. There is a possibility that the problem may be solved by the combination of 'free choice' under a supervising consultant, agreeable to and appointed by the insurance companies."

Dr. Emmet Rixford, of San Francisco, at the latest meeting of the American Medical Association (*Journal American Medical Association*, Sept. 30, 1916), indicates another difficulty:

"The friendly societies or fraternal organizations or lodges which have increased so prolifically during the last 50 years are organized largely to afford medical and surgical services at such cost as to be within the reach of the laboring classes, the monthly dues providing the means for the employment of community physicians. Many such, however, extend their membership to include people in much more comfortable circumstances, who join for the purpose of securing cheap medical and surgical service.

"The medical profession, therefore, finds itself opposed to what it considers exploitation of the profession. While from the standpoint of cheapness this scheme works well enough for the members of the societies, it often—in fact, generally—fails to secure to the patient competent medical service. Investigation has shown that in these societies the payment to the doctor is far less than \$1 a visit on the average, and in some cases as low as 25 cents. The members paying monthly dues, and not so much per visit, run to this doctor on the most trivial excuse, thereby unduly multiplying the number of visits. Some of these lodge doctors see 40 patients a day, receiving therefor from \$100 to \$150 a month. It is no wonder, then, that the medical work done, is as a rule, of the most perfunctory sort.

"Under workmen's compensation and compulsory industrial accident insurance, practically the whole of traumatic surgery is taken from the lodges; and if insurance against illness of workmen becomes a fact in this country, as it has in England and Germany, the *raison d'être* of most of these associations will have disappeared. England and Germany, however, instead of destroying these societies, have utilized those of them which are financially sound, and have in fact commissioned them to take care of

accident and illness of members, but under strict governmental supervision."

If we have unlimited free choice, how can we get patients into hospitals from institutions?

Germany before the war started a propaganda, which is being carried out under war conditions, which is proving that workmen with one leg and with no legs, with one arm and no arms, with one eye and no vision at all, with shortened limbs due to serious injuries other than amputations, can be furnished with employment suitable to their condition in life. The saving to industry of skilled workmen, men who have followed industrial pursuits all of their lives, cannot be estimated.

Perhaps I have gone far afield from the subject assigned me, but as I feel that early, adequate and continuing medical care is necessary to preserve our trained men, I make no apology.

Cure is better than controversy.

Fee tables are simply makeshifts. The great principle underlying all of compensation is adequate treatment from start to finish, and the measure of medical services should not be the measure of the medical costs, but the measure of medical results.

I am not yet convinced that State medicine is to be the cure of our medical evils. A medical trust, no matter how euphemistically disguised, is still a medical monopoly. To-day's medicine is still in the control of a profession which has ideals and traditions of professional conduct and morals, who up to date have not measured their services by what they have taken from the community, but by what they were able to give.

#### PHYSICAL EXAMINATION AND MEDICAL SUPERVISION OF FACTORY EMPLOYEES.\*

By W. IRVING CLARK, M.D., WORCESTER, MASS.,  
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##### PHYSICAL EXAMINATION OF EMPLOYEES.

*History of Development.*—The physical examination of factory employees is a comparatively new undertaking. Previous to five years ago, except in Chicago, there was, so far as I know, no physical examination of employees by any factory in the United States. About 1910 an antituberculosis society of Chicago, under the efficient management of Dr. Sachs, succeeded in interesting a group of employers in the physical examination of their employees for tuberculosis. Following this work, other factories began considering the advisability of establishing examinations, with the point of view of increasing the efficiency of their force and assisting in the tuberculosis movement, which at that time was sweeping the country. In 1911 the Norton

\* Read at the Conference on Social Insurance, Washington, D. C., December 6, 1916.

Company, at Worcester, Mass., started examining its employees, examination being complete and not confined only to the chest. About this time Dr. Harry Mock, of Chicago, was doing practically the same work, and I am inclined to think that he anticipated the Norton Company by one or two years, and is entitled to the position of the first to establish complete examinations. In 1913 a number of firms had taken to the idea, and during the last three years the movement has spread through many of the large factories in the country.

Mr. Mangus W. Alexander, of the General Electric Company, West Lynn, in a personal letter, states that after sending a questionnaire to 300 large firms in the United States, he received definite information that 35 firms were making physical examinations, as well as attending to the injuries of their employees. It is, therefore, evident that although the movement is spreading it is still very much in the air and has not reached large proportions through the United States.

#### REASONS IN FAVOR OF PHYSICAL EXAMINATIONS

*Advantage to the Employer.* A complete examination of every employee, while expensive, is undoubtedly of great advantage to the employer. First, because it enables him to select a man for the work to which he is best physically fitted. Second, because it enables the doctor who makes the examination to instruct and advise the employee of any defects which he may have and of which he is not aware, and by enlisting his cooperation enabling the man to overcome these defects, where possible, and thus to increase his physical efficiency. Third, it prevents the introduction into the factory of men who are undesirable because of severe defects. Fourth, it prevents contagious diseases entering the factory and becoming established there.

*Advantage to the Employee.*—First, while passing through his complete examination he is informed of any defects which he may have, and is assisted in obtaining relief. Second, he is not put to work for which he is not physically fitted. Third, he knows that every other man in the shop has had a similar examination and readily appreciates the fact that he will be thrown in contact with men from whom he cannot contract contagious diseases. Fourth, he feels that the factory is taking a personal interest in his condition and that he can go to the doctor for further advice if he considers it necessary. This is of very real importance to the average shop employee, who frequently moves from place to place and who has no family physician. Such a man feels pretty sure that the factory is not employing a man who is not perfectly competent to handle any condition which he may have.

#### OBJECTIONS TO PHYSICAL EXAMINATIONS.

Objections have been made to the theory of physical examinations by labor organizations on

the grounds that, first, it infringes upon the liberty of the individual; second, that it gives the employer an opportunity to reject a man on account of physical defects whom he would otherwise employ; third, it might enable groups of employers, by an exchange of information, to blacklist practically a man who had a serious physical defect from obtaining any work; fourth, that a factory by having a complete record of the man's physical condition, had information which was of a professional nature and, therefore, did not belong in a business institution. These objections can be met by the following arguments:

First. That no man is forced to subject himself to a physical examination, as he can go elsewhere for his work.

Second. That the precedent has been established by the United States Government by the physical examination of recruits for the army, navy and civil service.

Third. Examination is used definitely to help the factory find proper work for the individual, so that it is for his advantage to be examined.

Fourth. That the effort of the manufacturer is not to turn labor away, but to secure it, while he makes every effort in his power to utilize every group of labor which can be utilized.

Fifth. Examinations are made by registered physicians and assisted by registered nurses, and the records are kept with the same secrecy which is maintained in a hospital or in a doctor's private office.

Sixth. That men having serious defects are frequently placed in other factories where their defects can be assisted or remedied, which would never occur unless physical examinations were made.

Seventh. A factory is totally unable to care for the physical conditions of its employees scientifically unless a basic knowledge of the employee's condition at the time of hiring is on file for the doctor's reference.

#### COMPLETENESS OF EXAMINATION.

The physical examination of the prospective employee should be as complete as that made for first-class life insurance. The eyes and the ears should be tested, the teeth examined carefully, and the entire body put through the same examination which would be given a patient at a general hospital. Blood pressure should be taken on all cases by the auscultatory method and a urinalysis should be done on all cases over 40 years of age, and whenever the blood pressure indicates possible kidney trouble. If possible a urinalysis should be done on all cases in order to determine cases of diabetes. Employees having defects of a serious nature should be re-examined after a certain period of time, and should be instructed to report regularly at the shop hospital.

#### LINKING THE EMPLOYMENT DEPARTMENT WITH THE HEALTH DEPARTMENT THROUGH PHYSICAL EXAMINATIONS.

The employment department of a factory is in very close touch with the health department. It examines the men mentally, just as the health department examines men physically. The employment department, having determined that the man is mentally fitted for a certain type of work, turns the prospective employee over to the health department to determine whether he is physically capable of handling the work. If the health department approves after examining the applicant, every possible effort has been made to select the right man for the right position. This is of obvious value to the factory, but it is also of great value to the employee, because he is placed in a position where every advantage is given him to do the best work of which he is capable and from which he has more opportunity to rise than if in a department or position to which he is unsuited. So close is the connection between the two departments at Norton Company, that with the safety engineering department a triad is formed which has a bi-weekly conference upon matters where the three departments come in touch. The smooth and intelligent coöperation between these three departments produces almost ideal handling of the problems of the employee.

#### TECHNIC OF EMPLOYMENT AT NORTON COMPANY.

As this method is probably the same used in many other factories, we will cite it in order to show the way in which the prospective employee is handled. The applicant finds himself in a waiting room, well lighted and heated, and where he has a comfortable chair to sit in. When his turn comes he is taken to another room where he is given a seat at the desk of the interviewer. This interviewer takes his history, talks with the man of his past work, and endeavors to gauge his ability to fill any of the positions which are open. After having decided that the man is best fitted for a certain position, and his card having been filled out, he is taken and personally introduced to the doctor who will examine him. The examination is made with every care not to offend in the slightest degree. The man is shown to a dressing-room, where he removes the upper part of his clothes, and then steps into the examining room, where he has the same privacy that he would have in a doctor's office. The examination is made with rapidity but with great thoroughness, and the results are printed upon the physical examination card of the applicant. Before the examination is over the applicant has been completely examined from the top of his head to the soles of his feet. He is then told to return to his dressing-room and dress up. His physical examination card and the card filled out by the interviewer in the employment department are gone over together by the doctor, and the man is approved or dis-

approved for the work to which he is assigned. If disapproved, an effort is made to find another position in which he can be employed. In questionable cases the matter is taken up to the superintendent, who has the final authority. Whenever an employee is transferred from one department to another, when such transfer involves a change of work, another examination is made in order to determine whether any defects have developed as a result of the work he has been doing, and to make sure that he is fitted for the work to which he is now assigned. All examinations are entered on special cards, which are kept constantly on file, files being cleared as fast as men are discharged.

#### ATTITUDE OF EMPLOYEE TOWARD EXAMINATIONS.

The attitude of the employee toward examinations is distinctly favorable. In discussing this matter with a number of physicians in industrial practice, I find that there is little or no objection to the examination, if the applicant is given to understand clearly its advantage to himself and its necessity for his intelligent after-supervision.

During the last year we have made over 5,000 examinations of applicants at Norton Company, with only two refusals. These men stated they were seeking only temporary work, and did not consider it necessary.

I believe that with increasing knowledge of its value there will be little or no objection by applicants, all objections which I have encountered having been due to suspicion and lack of information.

#### EXPENSE.

The expense varies very greatly, depending upon the size of the factory and the completeness of general supervisory work done. Roughly speaking, the expense of examinations is about one-third of the total cost of running a medical or health department.

M. W. Alexander has recently compiled an expense chart which, after an analysis of 41 large factories having medical supervision, shows that the total expense of all medical service, exclusive of compensation for injuries, and all overhead expenses for 223,416 employees, amounts to \$1.88 per employee per year. This would make the cost of physical examinations \$0.626 per employee. At Norton Company we find that the expense of examining amounts to \$1.00 per year per position in factory.

#### REJECTIONS.

So much of the objection to physical examinations is based on the rejection of physically defective men, that I think the matter is worthy of some discussion. In the first place the number of seriously defective men who apply for work is extremely small. The majority of these men are too old for the work for which they apply, or they have defects which are curable.

In regard to age, you will note that I state "too old for the work for which they apply." By that is not meant too old to work. There are often positions with good pay open to these men, but we admit frankly that to reject a man because of his age and the multiple defects arising from it seems unfair as long as the man is anxious to work.

There are several solutions to this problem, such as pensions and special industries where there is less danger in the work, but these matters belong more to other sections of this meeting.

In regard to rejections for remediable defects, it is evident that it is for the good of the man directly that he should not be permitted to injure himself working when a simple operation or the fitting of proper glasses will not only remove all danger but greatly increase his efficiency.

In these days of free hospitals and clinics, poverty is no excuse for not attending to these matters when they have been pointed out.

At Norton Company the restrictive list of defects is rather severe, because of the heavy nature of the work, but the percentage of rejections even there is only 3.5, and many of these men are later accepted after their defects have been repaired. In a number of factories all applicants for work passed by the employment department are accepted regardless of their physical condition, the work of the medical department being simply to note the defects found and endeavor to remedy the same.

#### GENERAL CONSIDERATIONS.

The above briefly outlined is the present status of physical examinations among the larger factories. In consideration of the obvious benefits to both employer and employee, it seems that the cost is justified and that the idea will spread. Dr. Hayhurst has developed a method by which groups of small factories can employ between them a physician so that the advantages of the idea are possible to all.

There are some broader possibilities in the universal adoption of physical examinations than at first appear.

The most difficult cases coming to a general hospital are those where the individual has ignored his physical condition or treated himself. Very many pathological conditions, if discovered early, can be cured outright, and many more held in check.

The average worker calls in a doctor only when he is seriously sick. A very large proportion, I should say, roughly, over 60%, have no family physician but call in the nearest physician. The majority of men if they are told of a physical defect and how it may be relieved or cured, follow the doctor's advice at least for a time, especially if that advice is consistent with their regular work. From this it will be seen that physical examinations have a strong tendency

to increase the health of the community, to make workmen more efficient, and to prevent absolute martyrdom in many cases.

Prevention is the present slogan of medicine. But prevention, to be of any value, must begin with the individual. Much can be done by education through the schools; much can be done by popular articles in papers and magazines, but on final analysis the only way really to accomplish preventive medicine is by personal contact with the individual. Thus every man examined as I have outlined above, knows either that he is sound or that he has defects, and if the latter, what he should do to remedy them; he knows the type of work for which he is best physically fitted; and, finally, he knows what a thorough examination is.

When we consider the possibility of all the workers in the country having this knowledge, each one being examined and reexamined as he passes from department to department and factory to factory, we see a possibility of preventive medicine affecting the entire country, and one perfectly possible of realization.

#### MEDICAL SUPERVISION.

Medical supervision begins as soon as an applicant for position becomes a member of the factory force. As we have pointed out, it begins during his physical examination and it continues until he leaves the employ of the company.

Medical supervision consists in:

1. Reexamination of defective workmen at varying intervals.
2. Reexamination of workmen transferred from one department to another.
3. Examination and advice with simple treatment in all cases of sickness.
4. Prevention of contagious disease by its immediate isolation when discovered, and by prophylactic inoculations and other measures.
5. Immediate treatment of all cases of accident occurring in the factory.
6. Subsequent treatment of all accidents occurring both in and out of the factory until the patient is able to resume his duties.
7. Supervision of sanitation.
8. Health publicity through monthly leaflets distributed in the pay envelopes.

Medical supervision can, therefore, be divided into the care and supervision of the sick, the care and supervision of the injured, and preventive measures.

The care of the sick is most important to the employer, employee, and the community. Very satisfactory results are possible by a well-organized health department.

The majority of sickness is preventable or can be ameliorated by prompt recognition, advice and attention. There are undoubtedly many acute ailments to which this does not apply, but the majority fall into this category.

By careful reexamination, considered diagno-



sis, and thorough detailed advice, the patient is given every opportunity for a quick recovery. Many minor conditions are treated specifically with simple drugs. These conditions are those for which the employee would not seek an outside doctor's advice, but which, if not cared for intelligently, materially reduce the working capacity of the individual, and may in time lead to more serious conditions.

The opportunity for more careful clinical study of the beginning of many pathological conditions is greater in the health department of a large factory than in any clinic, while the daily presence of the employee at the works gives the best "follow-up" facilities possible.

The industrial physician should, however, treat no case needing careful, constant medical attendance, nor should he attempt to treat men having sickness severe enough to incapacitate them for work.

For such conditions the patient should be sent at once to his family physician with all the data on the case the factory has been able to obtain.

In this way physicians will not only get their patients early in their sickness, but they will get information from the health department which may materially aid their diagnosis of the case.

As I have said before, I like to consider the purely medical function of the factory health department as a diagnostic clearing house.

#### SUMMARY.

The medical supervision of the sick should, therefore, be preventive, not curative. Its advantage to the employee is that sickness can be lessened, physical efficiency increased, contagious disease prevented, and absence due to sickness materially reduced.

Its advantage to the employee is obvious. When we realize that the proportion of time lost from sickness is from seven to ten times that lost by accident, the importance of reducing this to a minimum is evident.

#### CARE OF INJURED.

The care and supervision of the injured is so universal in the industrial world that there is now hardly a factory in the country which does not make some provision for its injured employees.

This very satisfactory condition of affairs has been brought about partly by the voluntary assumption of the obligation and partly by the Workmen's Compensation Act.

This care in many cases is limited to that provided by insurance companies, but in large factories it forms a part of the supervision, and is considered as a part of this work. To a surgeon who has worked in out-patient clinics for years, treating the many cases of sepsis arising from untreated accidents, which result in loss of time, loss of limbs, and sometimes of life, the results

of the immediate treatment of injuries occurring at a factory are nothing short of marvelous. Hundreds of consecutive injuries have been treated in factory hospitals without a case of infection, and when infection does occur it is handled so promptly and efficiently that the condition is stopped before it has a chance to become established. Moreover, in factory hospitals, treatment is not confined to the legal limit of two weeks. The patient is treated until he is able to resume work, and in this way much time is saved to patient and factory by the constant attention to the injury and the encouragement the patient receives.

Thus the one great weakness of the Workmen's Compensation Act, which limits the expense of medical treatment to two weeks, is overcome. Could anything be more thoughtless than a law which gives a man with, say, a broken arm two weeks' medical attendance free, and then, at the one time when he needs careful supervision most, to throw him on his own resources, necessarily reduced because of his lack of two weeks' wages.

#### PREVENTIVE MEDICINE.

Preventive medicine presents tremendous possibilities in hygiene and sanitation, but even greater possibilities in the promptness by which contagious disease is discovered, reported to the board of health, and isolated.

It is hardly necessary to point out the advantage to the community and individual of the early recognition of pulmonary tuberculosis, while actual prevention of typhoid fever can be obtained by the administration of vaccine. In no way can industrial disease be studied and measures for its prevention established but by medical supervision of the factory health department.

At Norton Company and in many factories a continuous campaign of health publicity is maintained by the publication of leaflets written in clear, simple language, illustrated when possible, upon subjects of health preservation and the symptoms of the more common diseases, coupled with simple advice as to their prevention.

#### COST.

The expense of maintaining such a health department in a factory varies with the extent and thoroughness of its activity. At present at Norton Company it amounts to \$3 per position in the factory per year. A careful digest of this question, with statistics, has recently been published in the *Iron Age* by Mr. Alexander.

#### SUMMARY.

And now let us consider briefly what all this means. It means first that by a comparatively small expenditure the factory obtains men physically fitted for their work, men supervised medically, so that they are kept in the best physical



condition, men who will be absent from work for a minimum time when injured or sick.

It means contented workers who realize that the factory takes a personal interest in their health and well-being.

It means a reduction of sickness in the community.

It means a minimum of permanent disability and rapid return to work after accident.

It means a quick prevention of the spread of contagious disease.

It means better and more hygienic working conditions.

It means a reduction and prevention of occupational disease.

It means a constantly increasing knowledge by workers of simple rules of health and prevention of disease.

If universally adopted, it would mean a physically and mentally better country. The sinews of production ever strengthened and guarded, the factory would cease to be considered a consumer of human lives, but would be considered rather as an educator and supervisor of health.

## THE FALLACIOUS SOCIAL PHILOSOPHY OF HEALTH INSURANCE.\*

BY FRANK F. DRESSER, WORCESTER, MASS.

I do not intend to bother you with the special problems which the employer as such must meet under the proposed health insurance measure. They are briefly:

The irritation and misunderstanding which are bound to arise between employer and employee when the former makes any deduction from the weekly wage for a cause not connected with the work;

The very considerable expense which will be occasioned to industrial employers and the annoyance and trouble to employers of agricultural and domestic servants by the constant bookkeeping, collecting and forwarding to the proper insurance carrier of the weekly contributions; an expense for clerical work merely which will amount to not far from a million dollars a year in Massachusetts;

The continued legislative changes which any statute, however perfectly framed, is bound to undergo at the demand of political exigency or selfish interest in this land of easy law-making and the constant and expensive readjustments which such changes involve;

And lastly, the disadvantage which employers in the states which first adopt the measure will find in competition with employers elsewhere.

But these problems are selfish and, in comparison with the whole question, trivial, and, as

\* Delivered before the Massachusetts Society of Examining Physicians, Jan. 8, 1917.

a matter of fact, I do not believe they will ever arise, for to me it is inconceivable that this Commonwealth, or any other of our states, will adopt a measure based upon the social philosophy which is the foundation of health insurance, once this basis is understood.

It is unnecessary for any one to tell an employer of the advantage of healthy employees. He knows better than any one else how seriously his profits are curtailed by the absence and ineffectiveness of workers, and he knows what wages they thereby lose. He finds this absence and ineffectiveness to be caused, not only by accident and by sickness, but by intemperance, by voluntary absence, by feeble-mindedness, by lack of vocational training, by sheer thriftlessness. It is surprising to find that the voluntary absence of wage-earners—that due to ball games, vacations and the like—is about as great and causes about as great a wage loss as the total absence and wage loss due to sickness and accident combined. Each of these means loss to him and loss to his workers. Whatever will diminish any of them inures to their mutual advantage.

If health insurance, as proposed, would reduce illness, the employer would believe in it, but it is because it will not reduce illness, and the cost is so disproportionate to any possible advantage, that he not only disbelieves in it, but feels that the desirable results can be obtained more cheaply and more effectively in other ways.

The reason that health insurance will not be effective is because in its essence and in its machinery it is a measure of relief and not of prevention.

It is relief, or charity, because a fund is provided for the benefit of a class in the community to which that class contributes only a portion, and the rest of the community pays the balance. For health insurance covers those only who are efficient enough to get and keep some kind of a job, but those who are so incapable or unfortunate that they cannot hold a job—the unemployable, the casual worker, the aged—are not covered at all, and the class which now fills our jails and poorhouses, and drains our charities, will still continue to prosecute their only successful occupation. And, also, because the measure applies only to employees; the large class of the self-employed, the small farmer, the small shopkeeper, the charwoman, the huckster, the journeyman, the home-worker, are without its scope. Yet these self-employed, though subject to the same risk of illness, and in the same economic conditions, must, nevertheless, contribute through the higher cost of their living, to the twenty-three millions of dollars which this measure will annually cost in Massachusetts for the benefit of the wage-earners alone.

The contributions of state and employer finally filter back to the consumers by way of

higher rents and larger prices for foodstuffs and materials which insured and uninsured must pay alike. It is doubtful whether the mass of poverty is diminished when one section of the poor is compelled thus to contribute to the alleviation of another.

It must be possible to devise some fairer form of relief, which shall reach all who are in need.

Health insurance is not a measure of prevention, because it hides and does not disclose responsibility, and to make any progress in preventive work you must first fix the responsibility and then assess it. The Compensation Act does this, but health insurance does not.

For example, every employer, bank, store, railroad, mill, farmer, housewife, pays the same proportion—two-fifths—but the responsibility is not the same; the responsibility of a bank in causing illness differs from that of a store or a railroad; the responsibility of a housewife in causing illness differs from that of a mill. Nor is there a distinction made between the responsibility of a dirty or a clean mill. The careful employer, associated with others who are less scrupulous, nevertheless, bears the same proportion of the loss they occasion. There is thus no merit to be obtained by a particular mill through reducing its sickness loss.

The same is true of the employee's contribution. His responsibility is by rule of thumb fixed at two-fifths, regardless of his environment, whether in city slum or healthful town, or his intelligence or habits of life.

Nor is there any distinction in the cause of the loss. The man whose illness is caused or prolonged by venereal disease or alcoholism is compensated as if he suffered from a malady to which his occupation contributed. The losses of non-industrial accidents are included, and these are greater in number than industrial accidents. Thus, if your cook is run over by an automobile on her afternoon out, or if my workman falls down his cellar stairs, they may come upon their respective funds.

The State under all conditions has its responsibility fixed at one-fifth, but if a backward town fails to install a proper water supply or if an inefficient local board of health fails to control an epidemic, employers and people insured and uninsured in the district suffer alike.

There is even a more glaring disregard of responsibility when the proposed measure is applied to Massachusetts. Our State alone now compensates for diseases which industry causes. Here it is possible for the worker to recover, under the Compensation Act, to which he does not contribute, his loss from a strictly occupational or a partly occupational disease. That measures the full responsibility of the Massachusetts industrial employer. Any charge to him beyond that is a charge for a responsibility which he does not have. The Act in Massachusetts, therefore, must either repeal this existing rule or be confined to the employers of agricultural and domestic servants and those indus-

trial employers who are outside the Compensation Act.

Because health insurance, as proposed, is a palliative rather than a discoverer and assessor of responsibility, it brings in its wake all the evils of charitable relief. Illness, as we well know, may be largely a state of mind. A person may, if he wills, yield or fight against it, but every provision of the measure is a temptation to the benefited person, as it would be to you and to me, to yield. Malingering has proved not only the bane of sickness compensation abroad, but we are told that it is a large cost in the health insurance business of private companies today. I trust that you will become familiar, if you are not already, with the medical investigations along these lines that have taken place in Germany. If I am correctly informed, it is very generally felt, not only by many physicians and economic investigators, but even by officials of the German Fund, that a knowledge of insurance not only sometimes causes, but frequently unduly prolongs, illness. For example, the cure of a fractured collar-bone, which used to take from twenty to forty days, now takes about eight months—and other things in proportion. Dr. Rubinow is my authority for the statement that the average number of days lost through sickness has risen in Germany during its insurance experience from six to nine days a year, and that even in the Leipzig Fund it rose from nine days to 10.4 in 1912 and to 11.3 in 1913. Insurance, therefore, has not reduced the sickness loss in Germany, and we may well wonder whether insurance here will operate to decrease or to increase our present sickness rate. The peak of expenditure for this relief has not yet been reached in Germany, and the investigators that I have mentioned state that its evil moral and hygienic results are increasing. We may well pause when a responsible German official terms this system "the all-pervading cancer that is destroying the vitals of our State." These are criticisms the truth of which we should clearly know, for it may be that in attempting to remove the tumor of poverty we are grafting a cancer in its place.

But the matter that most vitally interests you, and is the most important detail of the plan, is medical service.

This has been the difficult and disappointing feature of every system abroad, and there is yet no suggestion made which will remedy its evils here. The solution of the problem lies with the doctors and with no one else, but in deciding they must consider the conditions of the community in which they live, the standards and conditions of medical practice, and the frailty of human nature, from which even this best loved profession is not exempt. Medicine is a profession and not a business. It does not provide a commodity to be weighed, measured and sold in the market, but a service, intangible and invaluable, and measured by the conscience of

the giver. No layman can judge of it and, if competence be assumed, the adequacy of the service to be rendered rests almost wholly with the physician himself.

The first requisite, therefore, it seems to me (and please believe that I speak with humility and fear, for I do not listen with much patience to the crude comments of laymen on my own profession), is to make certain that the physician's conscience shall become more, rather than less, tender, that his standards of competency and adequate service shall rise and not fall.

Will the proposed plan raise or lower present standards? You can tell. I cannot. But unless it will surely raise them, then it is bad, and bad, not only for the profession, but for the community at large.

I feel safe in saying that if these local associations are to have anything whatever to do with providing medical care, that the result will be bad. Let us imagine the directors of the Machinists' Association or of the Housemaids' Association met to decide what method of medical care they will provide, what physicians and how many they shall employ, what they shall pay and what regulations they shall adopt. A dozen men or women, half employers and half employees, equally ignorant of medical requirements and attainments, filled with the loyalty that each of us has toward his own physician, agreed only on the principle that the cost must be kept down, met to solve by themselves a problem that no country abroad has yet successfully solved and that even the able proponents of this measure do not attempt! The statement of such a scheme makes it absurd. Can we believe that a board so constituted will know, or willingly provide, the modern requisites for adequate care, or that its methods will tend to more perfect, rather than to more slovenly work?

But what are our Massachusetts needs today? Here, better perhaps than in any state in the Union, the rich and the very poor throughout its territory can get competent medical treatment, but here, as elsewhere, the great middle class cannot; and they cannot get it, not because of poverty (the Dutchess County Survey, you will recall, showed that poverty was not the controlling cause in 79% of the cases that had inadequate care) but because your profession has made such amazing advances in the last twenty years that you have not had time to organize yourselves to provide it.

I wonder if the young, well-trained practitioner of today does not have to make many compromises with his conscience during the first few years of his practice. Coming from school and hospital, he feels the need of facilities for diagnosis that perhaps his means cannot provide. He feels even more the lack of power to call upon consultants. He knows that a charity patient at a hospital could have the service of every needed specialist, but he knows that his own patient at home, though expecting to pay according to his means, must be denied it, and

that his own guess cannot be checked or guided by other aids. If this young practitioner glides into practice among persons better off in the world's goods, his knowledge and competency increase because he is constantly taught by and associated with good men in other lines, but if his practice tends to be among the poorer people he has little chance to grow in wisdom, and he and his patients suffer.

Is it better for a patient to have competent service within his means of payment or to have indifferent service which is free to him? From the standpoint of the community at large there is no question, for the community has to pay the bill in either case.

Is not this the real question, and cannot you Massachusetts men solve it, and let the rolling prairies of the West have insurance and herb doctors if they choose?

There is a germ of a possible solution with which I have become infected.

The State Board of Health, or other proper State authority, could establish and maintain, in convenient municipal and country districts, diagnostic stations, with all necessary equipment, and with which all physicians practising in the vicinity should be connected. Such stations would have the library, the apparatus, the facilities for all necessary tests, with a pathologist, I suppose, in charge. The limits of the district which each station would serve would be clearly defined, and all illness occurring within the district would be reported to that station, with such safeguards as were proper to protect professional secrets. All physicians, wherever they lived, would as a condition of practice, be required to belong to the staff of some one station, although their practice would not be limited to the district of that station. At each station consultants or specialists would attend at stated times, to advise and examine the cases or patients who were brought there by the attending physicians. Such consultants would either be elected by the staffs of the stations or appointed by proper authority, and their fees for consultation at these stations would be fixed at so modest a sum that their service would be denied no one with any ability to pay. This would not, I take it, decrease the total income of such physicians because it would open up new fields. The fees or conditions of practice otherwise would not be affected nor would the regular hospital work. These stations might have in residence one or more physicians to answer the emergency calls or do the charity work of the particular district, and the district nurse might have an office there.

By requiring the illness of the district to be registered, the needful knowledge for preventive work or regulation would be secured.

The idea is to establish the closest coöperation in the several lines of professional endeavor, to mobilize in these groups all medical facilities and all practitioners and so bring the most competent care at the least cost to the door and to

the knowledge of everyone. Such organization would, I think, create an "esprit de corps," a force to elevate rather than to lower standards, a greater opportunity for the competent and ambitious young man, and a possibility of discovering and, through State authority, eliminating the unfit.

It does not contemplate giving free medical service to people other than those who now and always must receive it. There is no more reason for giving free medical service than free food. It is an attempt to bring adequate service within the means of all the people for the advantage of the patient, physician and community alike.

Of course the cost would be great, but it would be less than the medical costs under health insurance, and it would be paid by all for the benefit of all, not paid by all for the benefit of a few. I suppose that such stations could be obtained and equipped for a less amount than one year's contribution by the State to the health insurance fund, and that they could be maintained for not only a less amount than that, but for a sum less than the administrative costs which health insurance requires and which are theoretically wasteful.

But all these matters are details of the question, and I want for a moment to call your attention to the broader and more important issue that lies beneath this legislation.

Is the social philosophy on which health insurance and its sisters,—maternity insurance, invalidity insurance, old-age pensions and perhaps unemployment insurance,—rest a philosophy which we are prepared to adopt?—for we must agree that it is new and somewhat startling to our principles. We have been born to a belief in the individual; on that our State was founded; by it our progress has been made; because of it new peoples have come to our shores.

Elihu Root has lately stated it: "The central principle of our system of government is in the proposition that every man has a right to full and complete individual liberty, limited only by the equal liberty of every other man. . . . Our whole system of law is in its essence only the enforcement of the reciprocal limitations of individual liberty. . . . The justification of all laws and customs which constrain human conduct is that they are necessary and appropriate for the preservation of the liberty of others. Whatever law passes beyond that limit and seeks to impose upon the individual the ideas of others as to what his conduct should be, whether to subserve the interests of others, or to conform to their prejudices or to their ideas of propriety or wisdom, even though those others may constitute an overwhelming majority of the whole community, is a violation of the principles upon which our government was formed."

So, too, President Hopkins of Dartmouth: "We who believe in democracy as a political system do so in the full recognition of the fact that its merits are not secured without very considerable sacrifices.

Its virtues lie in the free play it gives the individual volition, which it puts under restraint only at the point where it must be curbed that other individual volitions may have their like free play. Thus to those of us who wish to live our own lives, with the minimum of outside interference, democracy becomes a very precious thing."

But the philosophy of health insurance is not individualism, it is collectivism; it is not democracy, it is the aristocracy of class.

The collectivist believes that the welfare of the state as a whole must be sought, because if the state is prosperous its members will be, and therefore the needs and desires of the individual must be subordinated to the advantage of the mass. John Smith, the individual, with his human desire to live his life under the law in his own way, wise or foolish, as it may be, is disregarded, and a class is created which shall live by rule, with part of its earnings taken and expended for it, with its illnesses scrutinized, with a dole given when misfortune comes.

For the first time in our history our democracy shall be stratified. A group shall be segregated and marked as incompetent to bear the common lot or live the common life.

That may do in Germany, where robber-baron and peasant have only lately changed to an aristocracy of bureaucrats and wealth; where property gives political power, and two per cent. of the inhabitants of Berlin elect one-third of its representatives, and four men have a similar voting power among the hundred thousand residents of Essen.

That may do in England, where, though there be political freedom, the class distinction of birth and land is hard and fast, and where great wealth, on the one side, is matched by a dire poverty unknown to us.

But that is not our American birthright. Our Commonwealth was founded on the dignity of the individual, not on the dignity of his birth, his purse or his calling. Opportunity to obtain the highest or the lowest place in our society is still open to everyone, and the ebb and flow of our people from one to the other is constant. It is our duty to keep this door open, not by the stratification of our society, not by regulating the life of the individual, but by regulating the conditions under which he lives and works.

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AMERICAN RED CROSS, BOSTON METROPOLITAN CHAPTER.—The Boston Metropolitan Chapter of the American Red Cross has issued a special appeal for an immediate fund of \$50,000, to provide first requirements for preparation in case of war, including equipment for three base hospitals of 500 beds each, and one sanitary training detachment unit. Of this sum \$8600 have already been subscribed. Contributions should be sent to James Jackson, Esq., State Street Trust Company, Boston.



## Original Articles.

## FAT EMBOLISM A CAUSE OF SHOCK.

BY W. T. PORTER, M.D., BOSTON.

[From the Laboratory of Comparative Physiology in the Harvard Medical School.]

## I.

At the beginning of a study of traumatic shock in wounded soldiers in France and Belgium,\* I asked what wounds were most often followed by shock. The surgeons at Compiègne and La Panne replied that shock was most frequent after shell fractures of the femur. It was less frequent after the fracture of the smaller humerus. These facts seemed to me very significant. Most of the shock wounds were from shell fragments, and shell fragments tear the bone and thus lay bare considerable areas of the bone marrow. The conditions for absorption from the bone marrow are excellent. Naturally, the investigator of the cause of shock would think first of the absorption of some soluble chemical agent that would cause the typical fall of blood pressure. It is known, however, that extracts of bone marrow, on injection into a vein, do not seriously disturb the circulation. The innocence of extracts seemed to exclude the production of shock by the absorption of a chemical substance present in the marrow. Yet there remained an undoubted relation between shock and broken bones. While revolving these facts in my mind, I read the paper in the *American Medical Journal*, 1916, p. 1926, in which Dr. W. W. Bissell again calls attention to the astonishing amounts of fat in the blood stream of persons with broken bones. I determined then to produce experimental shock, if possible, by injecting fat into the jugular vein.†

Fat embolism has been studied experimentally for two and a half centuries. I have made no effort to master its enormous literature, but I believe the following statements cover the facts that are of special interest here:

1. The fat in bones is in a condition peculiarly favorable to its entrance into the blood vessels after fracture.
2. Large quantities of fat have repeatedly been found in the blood vessels after fracture.
3. The entrance of fat into the blood vessels begins immediately after the wound.
4. Frequently, if not always, there is fat embolism of the brain and other organs.
5. These facts have often been observed in men; they are equally true of animals in which fat is injected into a vein.

Notwithstanding the very numerous clinical

\* See this JOURNAL, 1916, cxcv, pp. 854-858.

† Subsequently, I was encouraged in this idea by a remark of Professor Mallory, in whose laboratory at the Boston City Hospital Dr. G. S. Graham had studied fat embolism from another standpoint in 1907.

and pathological studies of fat embolism, there has been, heretofore, no attempt to demonstrate by measurements of the blood pressure a causal relation between fat embolism and traumatic shock. Yet the following experiments will show that this relation can hardly be denied.

## II.

The experiments to this writing are eight in number. They were performed on cats. In the first experiment, Feb. 2, 1917, about 3 cc. of the official emulsion of olive oil was injected slowly into the jugular vein. Very soon there was a fall in the carotid blood pressure. It was recorded by a membrane manometer, which also recorded the force and frequency of the ventricular contractions. In two further experiments thick cream was used, and in the remainder the fat was neutral olive oil. The injection of from 2 to 4 c.cm. of olive oil in a large cat has never failed to produce a fall of blood pressure to one half or less the normal level. Thus on Feb. 5, the diastolic blood pressure fell quickly from 140 to 65 mm. Hg., and later to about 40 mm. In this cat the tracing showed that the fall in blood pressure could not be ascribed to changes in the heart beat. The same is usually true when the injection is not made too rapidly. The clinical picture is essentially similar to that of traumatic shock in human beings. Similar also is the beneficial effect of inclining the animal until the portal vessels are higher than the heart and brain.

## III.

The following conclusions may be drawn:

1. Fat, often in large quantities, is known to enter the blood vessels in traumatic shock, the essential feature of which is a characteristic fall of blood pressure.
2. A similar fall, with the same resultant symptoms of shock, may be produced experimentally by the injection of fat into a vein.
3. Fat in the blood stream is known not to be injurious *per se*; its injurious effects are the product of fat embolism.
4. Fat embolism is a cause, though not necessarily the only cause, of shock after fracture of the bones.

# SHOCKLESS SURGERY. PARAVERTEBRAL ANESTHESIA WITH SCOPOLAMINE AND NARCOPHINE: A PRELIMINARY REPORT.

BY A. R. KIMPTON, M.D., BOSTON.

VERY little attention has been given to this form of anesthesia in this country, particularly in this section of the country, and I wish very briefly to report a few cases; later a complete report will be made.



Paravertebral anesthesia was introduced by Dr. Bernhard Kroenig of Freiburg, Germany.

Briefly, the method is the use of scopolamine and narcophine, followed by conduction anesthesia outside the dural space by means of one-half of one per cent. novocaine. I have used this method ten times, and feel that it is something that we are all coming to, especially in poor operative risks.

So far as I have observed there has been no shock whatever, and the patients remember little or nothing concerning the operation. They are relaxed, and exploration of the entire abdomen was made in my abdominal cases. *False teeth should be removed, as in ether anesthesia.* There probably will be some post-operative distention and pain, as after other forms of anesthesia, but so far my patients have had almost none of the first and very little pain.

All of my cases, with one exception, have been most beautifully anesthetized by Dr. Frank Konrad, who translated Dr. Kroenig's paper published in *Surgery, Gynecology and Obstetrics* for May, 1916, pp. 524-533.

To be successful, the conduct of the local anesthesia should be by a man trained for it, as ether anesthesia should be. I have Dr. Konrad see the patient the day before the operation, and he leaves his directions. The day of the operation Dr. Konrad arrives first, and the patient is ready for operation at a stated time. They are operated upon as though etherized, without further delay of local infiltration. It is not a method of local anesthesia for the surgeon to carry out, but I can most heartily recommend it as carried out above, and a further full report will follow.

My cases have consisted of:

Two very severe exophthalmic goitres, both operated upon with perfect satisfaction as to anesthesia.

One breast.

One inguinal hernia.

Two empyemas, one a child that died the next day. The death was due in no way to anesthesia, but rather to a neglected empyema. In this case scopolamine and narcophine were not used.

Two hysterectomies, one of the size of a sixth month pregnancy.

One papillary cystadenoma of the ovary. The tumor was tremendous in size, the patient not having been able to lie down for over two years. The adhesions were most troublesome. The operation was one that should have given tremendous shock to this elderly woman. She had none whatever, and the tumor not only filled the abdomen but displaced contents into the chest. This was a truly severe test of the method and a most perfect anesthesia.

One cancer of the urinary bladder. The anesthesia in this case was a complete failure, because not enough nerves were blocked off,—in other words, error in application.

## Clinical Department.

### AN INTERESTING TONSIL.

By JOSEPH PHENN, M.D., BOSTON.

It is the consensus of opinion of most of the profession that rheumatism, myositis and articular, is an infection secondary to a remote local infection; that the portal of entrance of this infection is usually through the tonsil; that the initial infection may take place in the mucous membrane of other parts of the body, such as the gums, nose and the sinuses, ear, pharynx, larynx and bronchi, intestines, and penis.

The mucous membrane being thin, highly vascular, full of lymph follicles, is capable of absorption either of the bacteria, when the surface epithelium has been destroyed by their chemical action, or of their filterable toxins.

That the absorption will be the greater when the inflammatory exudate is hemmed in with deficient or no drainage, is reasonable, and substantiated by observation. Hence, in carious teeth, where the pus is incased in the mucous membrane of the gums, in nasal catarrh, acute or chronic, with septal or turbinal obstructions, when drainage is deficient and when pus is incased in the sinuses, absorption will more readily take place.

The tonsil affords the greater absorption on account of its peculiar anatomical structure. This gland has many crypts from which numerous follicles branch out into the substance of the gland and are covered by mucous membrane, thus affording a larger area for absorption. The crypts are narrow, so that with the swelling of the mucous membrane due to inflammation, the exudate is closed in. The drainage is still more retarded on account of the natural position for physiological purposes of these crypts. The latter do not travel through the tonsil from above down, with the orifices pointing downward, but are at about right angles to the inner surface of the tonsil and their course is somewhat tortuous, so drainage is difficult.

We consider the tonsil injurious and its removal imperative when it has undergone repeated attacks of acute inflammation, with resulting general toxemia. The tonsil, in the first place, may be normal, but the patient is below par so that he cannot cope with the virulence of the microorganisms.

To diagnose a diseased tonsil is not so easy, and we must be guided by the subjective and objective symptoms, and the former are very important. Under objective symptoms we have soft, boggy tonsils, crypts full of debris, enlarged cervical glands (ruling out other causes). The amount of visible debris in the crypts of the tonsil is not always in proportion to the disease of the tonsil. It may simply mean a dilatation of the crypt by the pressure of the debris, with very good drainage. We see it some-

times in older people who do not manifest any other objective signs and subjective symptoms. Its significance is only together with either objective or subjective symptoms, showing obstruction in the depths of the crypts. The latter may be so dilated as to coalesce with the destruction of the intervening glandular structure, simulating Vincent's angina, or specific tonsil, when in reality it is nothing but a necrotic tonsil, as is proven by the absence of any inflammatory zone or spirilla, and a negative Wassermann. In cases of this sort, even in the presence of cervical glands, slicing of the whole length of the tonsil, so as to establish drainage, may be sufficient.

What can we expect from the enucleation of the diseased tonsil? Certainly, the removal of a focus for new infection. We cannot always, however, expect a cure of the rheumatic infection on account of the "local tissue sensitivity, and living bacteria in a metastatic lesion may continue the process independently of the focal source."

The case I am about to describe will illustrate the importance of subjective symptoms alone.

A woman of about thirty, married, enjoying good health, well developed and nourished, bowels regular, had follicular tonsillitis about eight months ago. Since then she complained of rheumatic pains in the right side of her neck, and practically all the joints. At times the pain would be very severe, so that she was unable to sleep. Osteopathic and electric treatment did not seem to help her case. Dr. H. Morrison, unable to find any cause for her rheumatic infection, considered the tonsil as a possible focus. On examination, the teeth were in good condition, nose normal, the tonsils were small and submerged, of normal appearance and consistency. The right tonsil, however, on the side of the neck of which she complained of pain, was adherent to the anterior pillar, no crypts could be made out at all, and it appeared a little bit harder than normal. It gave the impression of tension. Operation was advised on the following ground, assuming that the orifices of the crypts were closed by previous inflammation, incasing within them some infectious material. The writer was prompted to this conclusion mainly by her subjective symptoms.

Enucleation of the tonsils was performed. On cutting the right tonsil open, free pus welled up from all the crypts, showing that it was under tension. It was demonstrated to the satisfaction of Dr. Morrison and myself. The symptoms had greatly subsided soon after.

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## Book Reviews.

*Mentally Deficient Children.* By G. E. SHUTTLEWORTH, B.A., M.D., and W. A. POTTS, M.A., M.D. Fourth Edition. pp. xix, 284. Philadelphia: P. Blakiston and Sons Company. 1916.

A great many books on mentally deficient children are very unsatisfactory because of the one-sided treatment of the subject; but this book, though small, covers the field in a surprisingly satisfactory manner. The authors show repeatedly an accurate knowledge of the work that has been done in the United States, both in the development of the care of these children, and the methods of training, and also works done in this country in other directions, as psychological and sociological.

Although it is unkind to lay undue emphasis upon minor points, when one knows the enormous difficulty of choosing what shall be passed over lightly, or omitted, when the space at one's disposal is limited, it seems a serious defect in the chapter on mental examination that space should not have been found for a description of the modern mental tests, such as those of Binet-Simon, Dr. Fernald and Dr. Healy. This omission, and the rather unsystematic account of what is known of the pathology of cases of mental defect in children, are the most unsatisfactory parts of a book which deserves to be widely read, not only for the large number of facts made accessible in handy forms, but also because of the judgment with which it is written, the certain mark of men of wise experience and maturity.

*Progressive Medicine.* Edited by HOBART AMORY HARE, M.D., assisted by LEIGHTON F. APPELMAN, M.D., Dec. 1, 1916. Philadelphia and New York: Lea and Febiger.

This fourth issue for the year 1916 of this standard American digest of advances, discoveries and improvements in medical and surgical sciences, deals particularly with diseases of the digestive tract and allied organs, the liver, pancreas, peritoneum, kidneys, genito-urinary diseases and surgery of the extremities, including shock, anesthesia, infections, fractures, dislocations and tumors. There is also a practical therapeutic referendium, noting alphabetically the principal advances in materia medica during the past year. The volume is well illustrated with ninety-six figures in the text and maintains its familiar standard as an epitome of medical progress.

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### THE SHADOW OF WAR.

SINCE the previous issue of the JOURNAL was on the press, the great European War has cast its shadow even more menacingly upon America. The severance of diplomatic relations between the United States and Germany, though by no means making war between these countries inevitable, brings it measurably nearer. It should be the earnest wish of every humane and loyal American that actual hostilities and bloodshed, between two great nations of cognate race and ancient friendship, may be avoided with honor. In the unhappy event of a declaration of war, the duty of every American citizen is written with unmistakable clearness, whatever his previous sympathy and interests. Upon the medical profession would fall the obligation of discharging under the conditions of war the same duties to which it is devoted in times of peace. Whatever the position, civil or military, which it may become his lot to occupy, every member of that profession may be relied upon for unflinching loyalty to his country and to humanity.

### INDUSTRIAL HEALTH INSURANCE.

SINCE the latest editorial discussion of the subject in the JOURNAL, the consideration of industrial health insurance and workmen's compensation has continued among both legislators, physicians, and the public at large. In another column of this issue of the JOURNAL we publish a report of the meeting held in Washington, to correlate, if possible, the various interests and points of view involved in the question. We also publish in this issue a separate group of papers devoted to different aspects of the same subject. Two of these were among the papers presented at the Washington meeting; the third represents an address delivered before the Massachusetts Society of Examining Physicians on January 8. This paper by Mr. Dresser of Worcester was in direct rejoinder to an address in advocacy of industrial health insurance by Dr. Rubinow. Finally, we are also publishing in this issue a statement presented by Mr. F. M. Williams at the Washington meeting, summarizing the compensation laws already in force in the various states of the Union. The JOURNAL has previously stated its critical and judicial attitude towards industrial health insurance and cognate forms of social legislation. In its issue of February 1 was published the text of the proposed new Young bill, with editorial comment. The JOURNAL has freely admitted, and will continue to admit, to its columns contributions discussing these important subjects from every point of view. The present group of material is published as a further contribution towards illuminating and clarifying professional and public opinion. The bearing of present and proposed legislation on the welfare of the medical profession and of the community is so momentous that all disposed to partisanship should weigh carefully the arguments of all sides before reaching a decision.

### THALAMIC LESIONS AMONG CIVIL WAR VETERANS.

ALTHOUGH our knowledge of the optic thalamus and its lesions has been given considerable impetus since the published experiments of Ernest Sachs, in 1909, we are still somewhat at sea as to the exact relation which that organ has to the emotions. Guilfoyle considers it proved beyond question that there is some connection;

what it is he does not know. We know the loss of control over the usual expressions of emotion, laughing and crying, that is associated with the thalamic lesions.

In a study of a thousand cases of brain diseases which came to autopsy, Dr. A. B. Evarts found 31 cases of lesions of this organ, or 3%; of this number half were Civil War veterans. This is remarkable in that the admissions to the hospital from which she took her figures show only about one-fifth to be of this class. Evarts is inclined to attribute this to the tremendous emotional strain which these people must have undergone at a time when brother fought against brother and father against son. As she says: "Therefore, it does not seem at all unlikely that this awful emotion should have left the thalamus a vulnerable point at which a definite lesion might be expected when arteriosclerosis appeared in due course of time. Reasoning from this conclusion, then, we learn that we may expect to find, in the history of a patient suffering from the thalamic syndrome, some unusually severe and long-continued strain."

This is one of the medical oddities which has, perhaps, no obvious utilitarian value, but which impresses us with the delicate harmony which runs through all our knowledge. We are gradually coming to understand more of the intricate functionings of the brain itself. With the dawning of this knowledge it is borne in upon us that certain parts of the brain are associated with the lowest order of psychic functioning,—the pleasure-pain reaction. Leading upward in a delicately graded scale, are the parts associated with the higher functions, terminating in the realm of pure intellect. Not, of course, that we conceive of this organ as a complicated arrangement of parts, each one of which has to do with a distinct function; we must speak much more generally than that. But we are coming to associate certain parts of the brain with definite evolutionary planes, and any such confirmatory evidence as the above, no matter how minute its weight, is welcome.

#### MEDICAL NOTES.

**ACCIDENTS IN NEW YORK CITY.**—Statistics of the number of killed and injured in accidents in New York City have recently been published.

"The total number, 23,300, does not include those reported in accidents but not injured, so

that the grand total of all persons in reported accidents in New York city in the year would rise above 29,000 persons.

Motor vehicles killed 283 persons in the streets of New York, passenger vehicles being responsible in 177 cases. Motor cycles killed no one, but contributed 377 accidents to a grand total of 6500 in which autos figured, the passenger ones striking nearly 5000 persons. Thirty-one hundred accidents were due to horse-drawn vehicles, and in these the passenger vehicles are responsible for only about 250. In fact bicycles in New York throw down more persons than pleasure carriages and hacks by about forty per cent, while the fatality record is the same for the two classes of vehicles, three persons each.

Railway accidents in the streets, to the number of 23, claimed 13 deaths, while street cars caused 1771 accidents with 77 deaths. Nearly 3000 persons were injured and 47 killed alighting from vehicles, while 300 were hurt and 9 killed stealing rides. There were 2400 collisions with 41 deaths and 420 runaways with 13 deaths. Aside from the street traffic there were 3000 falls with 24 fatalities and 580 persons hit by falling objects, one of whom was killed. Dog bites amounted to 120 in the year.

Another analysis of about 18,000 accidents places the responsibility. Way crossings of streets account for 3300 accidents,—a matter that is very plainly preventable,—while playing in the street figures 1200 more. Four hundred and seventeen individuals were injured while stealing a ride. Altogether the individual hurt was responsible in 8600 cases. The driver was at fault in 700 instances, with such matters as speeding, recklessness, wrong side of street and turning the corner improperly the major factors. There were 8 injuries on account of improper towing, preventable; 14 due to failure to signal, preventable; 31 for various items of disregard for the regulations, preventable; 36 by backing, preventable, and 20 by driving vehicle onto the sidewalk. There were nearly five hundred accidents due to defects in steering gear or other vehicular matters, all preventable, and 400 injuries through skidding."

#### EUROPEAN WAR NOTES.

**BRITISH BIRTH RATE DURING THE WAR.**—Report from London on February 3, notes among the civilian population of England an increase of death rate and decline of birth rate since the outbreak of the European War.

In the year in which the war began, there were 362,354 more births than deaths in England and Wales. In 1915 the excess of births over deaths was only 252,201. There were 64,569 fewer births and 45,584 more deaths in 1915 than in 1914.

**IMPROVEMENT OF TEETH FROM WAR FOOD.**—Report from Berlin on January 31 states that since the outbreak of the European War there



has been a notable improvement in the dental condition of school children on account of the elimination from their dietary of candy and soft foods and the use of war bread and other foods requiring more vigorous mastication.

**WAR RELIEF FUNDS.**—On February 10 the totals of the principal New England relief funds for the European War reached the following amounts:

Belgian Fund .....	\$258,582.40
French Wounded Fund .....	194,883.27
Armenian Fund .....	147,698.54
French Orphanage Fund ....	83,320.18
Surgical Dressings Fund .....	66,442.66
Polish Fund .....	60,791.78

#### BOSTON AND NEW ENGLAND.

**WEEK'S DEATH RATE IN BOSTON.**—During the week ending Feb. 3, 1917, the number of deaths reported was 307, against 278 for the same period last year, with a rate of 20.73, against 19.06 last year. There were 43 deaths under one year of age, against 47 last year, and 124 deaths over 60 years of age, against 100 last year.

The number of cases of principal reportable diseases were: diphtheria, 75; scarlet fever, 38; measles, 121; whooping cough, 6; typhoid fever, 3; tuberculosis, 37.

Included in the above were the following cases of non-residents: diphtheria, 12; scarlet fever, 5; typhoid fever, 3; tuberculosis, 2.

Total deaths from these diseases were: diphtheria, 5; whooping cough, 1; tuberculosis, 22.

Included in the above were the following deaths of non-residents: diphtheria, 1; tuberculosis, 1; whooping cough, 1.

#### Miscellany.

#### WASHINGTON CONFERENCE ON SOCIAL INSURANCE.

FROM December 1 to 9, 1916, there was held at Washington, D. C., a conference on social insurance summoned by the International Association of Industrial Accident Boards and Commission. The secretary of this organization is Dr. Royal Meeker, chief of the United States Bureau of Labor Statistics, who has been the moving spirit in the establishment of the conference. The president of the Association is Mr. Dudley M. Holman of Boston, formerly chairman of the Massachusetts Industrial Accident Board.

At this conference were representatives from nearly every state in the Union, so that its meeting becomes a matter of national scope. It was intended as a clearing house for an exchange of views and for discussion between those concerned with the many complex problems involved in the entire subject of social legislation. The proceedings of the conference are to be published by the United States Government.

Before the various sessions of the conference a large number of papers were presented dealing with the merits and demerits of different forms of administration, with compensation schedules of war, lump sum settlements, basic principles of rate making, accident prevention in connection with workmen's compensation, medical services and hospital fees, physical examinations and medical supervision of employees, defects in existing laws, occupation diseases, health insurance, pension systems and old age, invalid, unemployment and savings bank insurance. Among the Massachusetts representatives who presented papers at the conference may be mentioned Mr. Dudley M. Holman, Dr. Richard C. Cabot, Dr. Frederic J. Cotton, Dr. Francis D. Donoghue and Dr. David L. Edsall of Boston and Dr. W. Irving Clark of Worcester.

At the session of December 6, Dr. Francis D. Donoghue, medical advisor of the Massachusetts Industrial Accident Board, emphasized the importance of adequate medical service as a leading feature of workmen's compensation, if not the most important feature of the compensation, for the living workman.

"In return for the waiting period, generally provided in compensation laws, where no monetary consideration is paid, provision is made for medical and hospital services and medicines when required. Since most cases in Massachusetts, as in other States, do not last long enough to be paid compensation in the form of money, we should scrutinize carefully any substitute for the best medical services that it is possible to offer. Further than this, with the administration of various laws, a better correlated system of treatment than the ones in vogue hitherto may be developed.

"A completely efficient hospital for the proper care, treatment, reëducation and readjustment by personal study of an injured employee has yet to be constructed and maintained. The charitable idea underlying the establishment of hospitals still prevails, and the appeal to the heart is much stronger in the case of the crippled child than it is in the case of the crippled adult, even though he has depending upon him a number of children who may become crippled by reason of lack of nutrition or the invasion of disease, if the bread winner of the family is partly or totally disabled from work for a considerable period.

"If it were possible, every injured workman

should be kept under medical supervision from the time he was injured until able to resume his work. Such supervision should not be of such type as to be unduly expensive, and if properly carried out would save much time to the worker as well as to the employer of labor. It would have the additional advantage that the injured man would be in contact with encouragement and sympathetic treatment; when left to his own devices, he might not make his best effort, or he might not make his best effort at the opportune time. Early return to work is greatly helped by the assurance given by the doctor that it is safe."

Dr. W. Irving Clark of Worcester described the health department maintained by a large industrial plant at an annual cost of \$3.00 per capita providing periodic physical examination and constant supervision for its workmen. He emphasized the following points in the significance of such a measure.

"It means contented workers who realize that the factory takes a personal interest in their health and well-being.

"It means a reduction of sickness in the community.

"It means a minimum of permanent disability and rapid return to work after accident.

"It means a quick prevention of the spread of contagious disease.

"It means better and more hygienic working conditions.

"It means a reduction and prevention of occupational disease.

"It means a constantly increasing knowledge by workers of simple rules of health and prevention of disease.

"If universally adopted, it would mean a physically and mentally better country. The sinews of production ever strengthened and guarded, the factory would cease to be considered a consumer of human lives, but would be considered rather as an educator and supervisor of health.

"Preparedness is the watchword of the day. Can we better prepare for our industrial future than by urging the medical supervision of factory employees?"

Mr. Dudley M. Holman, in his presidential address, dealt in part as follows with the economic waste involved in industrial accidents.

"It is a very conservative estimate to state that annually 250,000 workers are permanently thrown out of employment through accident or preventable disease in the United States alone. These men and women must be supported somehow. Part of them receive whole or partial support under the provisions of the workingmen's compensation act, and, while this solves in whole or in part their individual problem of existence, it does so in most States only for a

limited period, and after six to ten years of idleness, when their compensation ceases, they are left in a most pitiable condition.

"Yet there is hardly one of these men and women who could not be put back into industry and a place found for them where they could support themselves, in part, at least.

"This economic waste caused by the apparently enforced idleness of this vast army of men and women exceeds \$100,000,000 a year of added burden, and amounts to not less than a billion dollars annually, a figure that is constantly being increased by the addition of a quarter of a million cripples each year.

"Much of this burden is primarily borne by the insurance companies, but they pass it along so that in the end the burden falls on society in general. This waste is a by-product of industrial inefficiency, for by prevention of accidents and disease seventy-five per cent. of these men and women would never become disabled."

At the session of December 7, Professor Willard C. Fisher, of New York University, outlined some of the defects in the workingmen's compensation laws now in force in thirty-four States of the Union, and suggested certain desirable changes.

"The wide and rapid spread of compensation legislation in all quarters of the world often has been cited as proof of a universal approval of the principles upon which it rests. In particular, we in the United States have declared with something of pride and joy that within the brief space of five or six years compensation laws have been enacted for two-thirds of the states, containing three-fourths of our population and industry.

"But it would be a gross error to suppose that three-fourths of our employees, or anything like so many, are covered by our compensation laws—that three-fourths of those injured at their employment within the United States stand to receive what we euphemistically call compensation. This moment is not the time to decide, nor even to ask, whether American compensation statutes have been enacted with satisfactory rapidity of succession or whether their provisions are reasonably adequate to the need. But we cannot be too prompt in ridding our minds of any belief that three-fourths of the American wage-earners who are disabled at their tasks are entitled to payments on account of their injuries and losses. But a small percentage of those who are disabled by industrial accidents, even within the so-called compensation States, can secure any indemnities whatever under the compensation laws. The great majority either are not affected in the least by the laws, have only the poor privilege of suing their employers with somewhat better prospects of winning damages, or have more or less adequate medical care at the employer's expense, with no possibility of securing either

indemnities for lost earnings or payments on account of pains and suffering.

"The reasons for the narrowly limited practical beneficence of the American compensation statutes are several. In most of the States the acts do not apply at all to certain employments, even to some of the most important. In only a quarter of the States is compensation compulsory by simple virtue of the statutes and without regard to the wishes of employer or employee. In nearly all no compensations are payable except for disabilities continuing through and beyond a specified 'waiting period,' which commonly is two weeks. And in quite all of the States certain disabilities are denied compensation for one or another reason connected with their origins, characters, or consequences.

"The two classes of employees who are most widely denied the benefits of compensation are agricultural laborers and domestic servants. By omission from the enumerated lists, by specific exclusions in direct terms, by the numerical exemptions, or by the exclusion of those not employed for profit, these two classes are cut out nearly everywhere. Only in New Jersey are domestic servants covered equally with other employees; in Connecticut they are covered where five or more may be in common service. Nowhere else in the United States are they affected by either compulsory or optional statutes. Agricultural laborers are but little better off. Only in New Jersey and Hawaii are they covered equally with other employees. In Wisconsin they are covered where they work four or more together; in Connecticut and Ohio, where they work five or more for the same employer; while in Vermont, they are covered wherever at least eleven may be working regularly for the same employer. In these two classes there cannot be less than 3,000,000 employees within the so-called compensation States who are wholly deprived of the compensation benefits which most other employees are granted.

"But it is the waiting period which cuts off much the greatest number of injured workmen from the benefits of the compensation laws. The returns from the different States are not closely comparable, but, taken all together, they support the generalization that the most common waiting period, two weeks, prevents from half to two-thirds of those who are disabled by their injuries from having any compensation. Percentages of those disabled by their injuries and recovering within two weeks have been reported as follows: Massachusetts, 1913-14, 63; Wisconsin, 1914-15, 72; Ohio, Jan. 1, 1914-June 30, 1915, 70; Washington, 1915, 42; 10,000 iron and steel workers reported by United States Bureau of Labor Statistics, 60. As to the general desirability of saving the injured workman and his family every unnecessary loss of income through injury and suspension of wages, there can be no doubt whatever. The Federal census of 1910 showed adult male wage earners in manufacturing industry

generally receiving less than \$600 a year; and Mr. I. M. Rubinow's study of real wages through 1912 shows a marked decline in the latest of his years. It is not improbable that the recent great rise of prices has made it harder than before for the average American employee to take care of himself and his family. Under such conditions every suspension of earnings, even for one week, is likely to be a genuine hardship for the workman and his dependents."

It was not the intention of the Conference to adopt resolutions relating to particular policies or methods. It is clearly realized that much time and consideration are needed to work out the best, and that what is the best for one State or section may not be best for another. The real purpose of the Conference was clearly to define the various problems demanding solution at the hands of legislators.

#### WORKMEN'S COMPENSATION IN THE UNITED STATES.

MR. F. M. WILLIAMS, Chairman of the Workmen's Compensation Commission of Connecticut, in a paper on Medical Services and Medical and Hospital Fees under Workmen's Compensation, read at the meeting of the Conference on Social Insurance called by the International Association of Industrial Accident Boards and Commissions at Washington, on December 6, 1916, presented the following as an appendix to his paper:

##### APPENDIX.

In this appendix there are collected together the several compensation laws now in force, with the official description of each act, the place where it can be found, and a brief outline of its provisions as to medical, surgical, and hospital services.

1. FEDERAL ACT.—Becoming effective September, 1916. House resolution 15316, Sixty-fourth Congress, section 9: Government must furnish to the injured employee reasonable medical, surgical, and hospital services and supplies, without limit as to time or amount, and if necessary, transportation of injured employee to the place where he can be properly treated.

The States and Territories having statutes on this subject are arranged alphabetically.

2. ALASKA.—Effective July 28, 1915. Chapter 71, Laws of 1915, section 16: In fatal cases where deceased left no dependents, funeral expenses not to exceed \$150 and other expenses, if any, arising after injury and before death not to exceed further sum of \$150.

3. ARIZONA.—Effective October 1, 1913. Title 14, chapter 7, Revised Statutes of 1913 originally enacted as chapter 14, Laws of 1912, special session, codified by chapter 7 Senate bill No. 70, fourth session, Laws of 1913, section 3170 (3): Reasonable expenses for medical attendance and burial in fatal cases where deceased leaves no dependents.

4. CALIFORNIA.—Effective as amended August 7, 1915. Chapter 176, Laws of 1913, as amended by chapters 541, 607, 662, Laws of 1915, section 15: A reasonable medical, surgical, and hospital treatment, including nursing, supplies, and apparatus for a

period of 90 days, with provision that the time may be extended in the discretion of the commission. Reasonable burial fee, not over \$100.

5. COLORADO.—Effective August 1, 1915. Senate bill 99, session of 1915, sections 50 and 52: Medical, surgical, and hospital treatment, medicines and apparatus as may be reasonably needed, but not to exceed 30 days or \$100 in value. Burial fee for fatal cases where no dependents, not exceeding \$100. Special provision in case of hernia for special operating fee, not to exceed \$50.

6. CONNECTICUT.—Chapter 138, Public acts of 1913, as amended by chapter 288, public acts of 1915, effective May 20, 1915, part B, section 7: Medical and surgical aid and hospital services as the injury requires, without limit as to time and amount. Section 9 provides in fatal cases for burial fee, \$100. There is also the usual provision that the commissioner having jurisdiction may pass upon the reasonableness of medical and surgical bills.

7. HAWAII.—Effective July 1, 1915. Act 221, session of 1915, section 12: Medical and surgical services during first 14 days not exceeding \$50 in amount. Standard of living clause. Burial fee not to exceed \$100.

8. ILLINOIS.—Effective July 1, 1915. House bill 841, session of 1913, as amended by senate bill 66, session of 1915, section 8A: Necessary medical, surgical, and hospital services for a period not longer than eight weeks and not to exceed in amount the sum of \$200.

9. INDIANA.—Effective September 1, 1915. Chapter 106, Laws of 1915, section 25: Medical services during 30 days. Section 26: Containing standard of living clause. There is also a provision for not to exceed \$100 burial fee in fatal cases.

10. IOWA.—Title 12, Chapter 8A, Iowa code, 1913 supplement, section 2477 m 9 (b): Services during the first 14 days of incapacity, not exceeding \$100 in amount. Also in fatal cases expense of last sickness and burial not to exceed \$100.

11. KANSAS.—Chapter 218, Laws of 1911, as amended by chapter 216, Laws of 1913, section 11A. No provision for medical services except in fatal cases where the deceased leaves no dependents; reasonable expense of medical attendance and burial not exceeding \$100.

12. KENTUCKY.—Effective August 1, 1916. Senate bill 40, Laws of 1916, sections 4-6: Reasonable medical, surgical, and hospital treatment for not to exceed 90 days in time or \$100 in amount, with special provision in case of hernia operations. Standard of living clause.

13. LOUISIANA.—Effective as amended August 11, 1916. Act 20, session acts of 1914, as amended by act 243, session acts of 1916, section 8 (4): Reasonable medical, surgical, and hospital services, unlimited as to time, not to exceed \$150 in value and in fatal cases reasonable expense of last sickness and burial not to exceed \$100.

14. MAINE.—Effective January 1, 1916. Chapter 295, Laws of 1915, section 10: Reasonable medical and hospital services during the first two weeks, not to exceed \$30 except in cases of major surgical operations, with special provision in fatal cases where there are no dependents for expenses of last sickness and burial not exceeding \$200.

15. MARYLAND.—Effective 1916 with amendments. Article 101, Annotated Code of Maryland, volume 3, Bagby's edition, section 37: Such medical and surgical services, etc., as required by the commission—unlimited as to time—not to exceed \$150 in amount. Further provision for funeral expenses in fatal cases where deceased left no dependents unless he left sufficient estate to bury him.

16. MASSACHUSETTS.—Chapter 751, acts of 1911, as amended by chapters 172 and 571, acts of 1912; chapters 445, 448, 696, and 746, acts of 1913; chapters 328 and 708, acts of 1914; and chapters 123, 275, and 314, acts of 1915, part 2, section 5: Reasonable medical and hospital services during first two weeks

after injury or incapacity, with further provision that in fatal cases where there are no dependents reasonable expenses of last sickness and burial, not to exceed \$200, shall be paid.

17. MICHIGAN.—Effective as revised August, 1915. Act 10, public acts of 1912; first extra session as amended by acts 50, 79, 156, and 259; public acts of 1913, and by House bills 238, 342, 345, and Senate bill 268, public acts of 1915, part 2, section 4: Reasonable medical and hospital services during first three weeks after injury. If no dependents, reasonable expense of last sickness and burial, not to exceed \$200.

18. MINNESOTA.—Effective as amended April 20 and July 1, 1915. Chapter 467, Laws of 1913, as amended by chapters 193 and 209, Laws of 1915, section 18: Medical and surgical treatment, etc., for not to exceed 90 days in time or \$100 in value, with especial provision that board may order such services for not to exceed 100 days in time or \$200 in value. Standard of living clause. In fatal cases burial fee and last sickness, not to exceed \$100.

19. MONTANA.—Effective July 1, 1915. Senate bill 157, section 14A-14F: Various provisions for mutual contracts as to hospital benefits, etc., subject to supervision of the board. General provision, section 16F, medical and hospital services during first two weeks not to exceed \$50 in value, and in fatal cases burial fee not to exceed \$75.

20. NEBRASKA.—Passed at session of 1913, effective by referendum vote. December 1, 1914, senate file No. 1, section 20: Medical and hospital services during 21 days after injury, not to exceed \$200 in value. In fatal cases, reasonable expenses of last sickness and burial not to exceed \$100.

21. NEW HAMPSHIRE.—Effective January 1, 1912. Chapter 163, laws of 1911, section 6, subdivision (1c): No provision for medical and surgical aid except in fatal cases where deceased leaves no dependents, in which event medical attendance and burial not to exceed \$100.

22. NEW JERSEY.—Chapter 95, laws of 1911, as amended by chapter 174, laws of 1913; and chapter 244, laws of 1914, section 14: Medical and hospital services during the first two weeks after injury not to exceed \$50 in value. Expense of last sickness and burial in fatal cases not to exceed \$100.

23. NEVADA.—Chapter 111, laws of 1913, as amended by chapter 190, laws of 1915, section 21C: Reasonable medical, surgical, and hospital aid as may be required not to exceed four months, with provision for medical and hospital agreements and assessments. In all fatal cases burial expense not to exceed \$125.

24. NEW YORK.—Chapter 816, laws of 1913, as reenacted by chapter 41, laws of 1914, and amended by chapter 316, laws of 1914; and further amended by chapters 167, 168, 615, and 674, laws of 1915, section 13: Medical and surgical services and attendance during 60 days after injury with standard of living clause. In fatal cases reasonable funeral expense not to exceed \$100.

25. OHIO.—Senate bill 137, acts of 1913, as amended by senate bill 296, acts 1913, and amended by Senate bill 28, acts of 1914, section numbers given are the section numbers of the Ohio Code; sections 1465 to 1489: Medical and hospital services in discretion of commission, unlimited as to time, and not to exceed \$200 in amount. In fatal cases reasonable funeral expenses not to exceed \$150.

26. OKLAHOMA.—Effective September 1, 1915. House bill No. 106, laws of 1915, article 2, section 4: Necessary medical, surgical, and hospital services during 15 days after injury. Standard of living clause. This statute does not apply to death cases.

27. OREGON.—Chapter 112, laws of 1913, as amended by chapter 271, laws of 1915, section 23: Medical and surgical attendance with hospital accommodations and transportation if necessary in the discretion of the commission, unlimited as to the time, limited to \$250 in amount. In fatal cases burial expense not to exceed \$100.



28. PENNSYLVANIA.—Effective January 1, 1916. Act 338, Laws of 1915, section 306 E: Reasonable surgical, medical, and hospital expenses limited to 14 days and \$25, unless major surgical operation is required, in which event cost not to exceed \$75. In fatal cases reasonable expenses of last sickness and burial not to exceed \$100.

29. RHODE ISLAND.—Effective as amended July 1, 1915. Chapter 831, Laws of 1912, amended by chapters 936 and 937, Laws of 1913, and chapter 1268, Laws of 1915, article 2, section 5: Reasonable medical and hospital services during first two weeks after injury; in case of death without dependents expense of last sickness and burial not to exceed \$200.

30. TEXAS.—Effective September 1, 1913. Part 1, section 7: Reasonable medical aid and hospital services, etc., during first week of injury. In fatal cases where deceased leaves no dependents or creditors expense of last sickness and funeral expenses not to exceed \$100.

31. VERMONT.—Effective July 1, 1915. Chapter 164, Laws of 1915, section 14: Reasonable surgical, medical, and hospital services during the first fourteen days not exceeding \$75. Standard of living clause. In fatal cases burial expense not to exceed \$75.00.

32. WASHINGTON.—Chapter 74, Laws of 1911, as amended by chapter 148, Laws of 1913, and chapter 188, laws of 1915: No provision for medical and surgical aid. Burial expenses not to exceed \$75.

33. WEST VIRGINIA.—Chapter 10, Laws of 1913, as amended by chapter 9, regular session of 1915, and chapter 1, extra session of 1915, sections 27 and 54: Reasonable medical, surgical, and hospital treatment in discretion of commission. Unlimited as to time, limited in amount to \$150, with provision for funeral expenses in fatal cases not to exceed \$75. Special provision that if operation and further treatment are necessary, not to exceed \$300 may be ordered.

34. WISCONSIN.—Chapter 50, Laws of 1911, reenacted by chapter 599, Laws of 1913, amended by chapters 121, 241, 316 and 369, 378, 462, and 582, Laws of 1915, sections 2394 to 2399 (1): Reasonable medical, surgical, and hospital treatment, etc., not to exceed 90 days. In fatal cases where no dependents reasonable burial fees not to exceed \$100.

35. WYOMING.—Effective April 1, 1915. Chapter 124, Laws of 1915: This statute contains no direct provision as to who must pay for medical treatment, but provides in section 20 for forfeiture by injured employees who refuse to submit to reasonable medical treatment and in fatal cases for burial fee not to exceed \$50.

Lest the impression go abroad that there is intention on the part of the sponsors of the bill to establish a 30 cent standard for payment of medical services, it is necessary to state that there are very serious statistical limitations to any such computation as has been made by Dr. Whitehill. To begin with, no one knows whether there are 9 or 6 days of loss of time through sickness per wage-worker in Massachusetts. Nothing but experience will demonstrate that—since the average varies between 5 and 10 days in Europe.

Another assumption is made by Dr. Whitehill that 1,000,000 workers must claim an additional 2,000,000 members of family, making a total of 3,000,000 under the law. The total population of Massachusetts on July 1, 1916, is estimated by the U. S. Census as 3,719,156. In 1910 the total population of the State was 3,366,416, so that during the 6 years the increase was about 10%.

The total number of persons with gainful occupations in 1910 was 1,531,068, which in 1911, on an assumption of an increase of 10%, was probably increased to some 1,684,000. Since only 1,000,000 wage-workers are to come under the law, or less than 60%, the total number of persons under the law is not likely to exceed 60% of the population or less than 2,250,000.

Even assuming that the estimate of \$8,000,000 as the total amount or remuneration for the medical work under the law is accurate, the only safe computation is that it would amount to over \$3.50 per capita, or \$300 per insured wage-worker. But how much work does that represent?

According to the experience of the Lelpzig fund, each insured person, on an average, requires for himself:—

- 5.0 visits to the doctor's office
- .6 visits of the doctor to patient's home

And the amount of medical service for the members of the family, amounted *per insured*, on an average, to:—

- 2.3 visits to doctor's office
- 1.3 visits to patient's home

Or taken together the amount of medical aid to be performed for each insured would be 7 1-3 office visits and less than 2 home visits. Eight dollars for that amount of work may be insufficient. It will be for the insurance funds, the state, and the medical profession to agree upon a more equitable basis of compensation; but surely even the basis suggested is far from leading to "30 cents per day."

I. M. RUBINOW, M.D.

## Correspondence.

### INDUSTRIAL HEALTH INSURANCE.

131 East 23d Street, New York City,  
February 7, 1917.

Mr. Editor:—

On the editorial page of the *Boston Herald* for Sunday, February 4, 1917, there appears a communication from G. E. Whitehill, M.D. concerning the "Medical Provisions of the Young Bill" which contains the following statement:—

"Social uplift writers are generally agreed that nine days' sickness is a conservative average for the general population and that the poorer paid workers do not receive the needed medical attention at present. Massachusetts can therefore expect at least 27,000,000 days' sickness from the 3,000,000 included under this bill. The advocates of this bill propose to pay \$8,000,000 for the medical care of the 27,000,000 days' sickness, less than 30 cents for each day's sickness."

### THE YOUNG BILL.

Boston, February 1, 1917.

Mr. Editor:—

The Young bill is no improvement on its predecessor. It throws out a sop to the general practitioner by means of its "freedom of choice" clause, and hence admits the necessity of making concessions. Concession is always a sign of inherent weakness. The weakness of compulsory health insurance, as its proponents are fully aware, in my opinion, lies not in methods, but in the principle.

If they can talk methods loud and long enough, the error of the principle may be overlooked. The assurance with which they speak of putting compulsory health insurance into operation in California this year, in Illinois the next, and in Massachusetts three years from now, would make me give pause to the following sentence did I not feel that I am supported by the fundamental law of the land.

Over my signature, I believe I was the first to raise the question of the constitutionality of this proposed legislation, and I now venture the prediction that not this year, nor next, nor any year will see it in operation, unless the Constitution of the United States un-

dergoes a change. Standing in support of this view are the recorded opinions of the American Federation of Labor, its Mass. State branch, the National Civic League, an ex-candidate for Governor of Massachusetts (himself an ultra-Progressive, who favors the legislation, but recognizes its unconstitutionality), the New York Society of Medical Jurisprudence, and finally the Insurance Economic Society. All agree that compulsion is indefensible under the Constitution. The Supreme Court of Massachusetts in its decision on the Workmen's Compensation Act, leaves little doubt as to what its attitude would be toward a compulsory bill. For these reasons I believe the whole question to be an academic one.

The Young bill reeks with class legislation. Here is an example. Part 2, Section 6, No. 1, allows the carrier freedom of choice in his selection of the genus, physician and surgeon. Part 2, Section 8, orders the carrier to go to the species, specialist, with whom the Funds have made special arrangement. Notice the distinction: freedom for the genus; restriction for the species. If this idea prevailed it would be perfectly possible to order the larger part of my practice to forsake me and to go to one of my eminent colleagues.

Such trifling inconsistencies pervade the whole bill, which is the sum total of an effort to do by state control, what ought to be the product of private endeavor; which monstrosity is known as Socialism.

Yours truly,

JOHN J. HURLEY, M.D., F.A.C.S.

#### WORKINGMEN'S INSURANCE IN GERMANY.

Everett, Jan. 27, 1917.

Mr. Editor:—

If no one has anticipated me I would like to call the attention of your readers to a monograph entitled: *The Practical Results of Workmen's Insurance in Germany* by Dr. Ferdinand Friedensburg, for twenty years in the Imperial Insurance Office in Germany. This was first published in 1911, a translation was reviewed in the *New York Times*, July 9, 1911. In October, 1911, the Workmen's Compensation Service & Information Bureau of N. Y. City sent out many copies, which are now found in some if not all public libraries. This bureau has no copies on hand at present. Wm. Rodman Fay of Boston takes up the subject of this monograph in *The Boston Daily Advertiser*, Jan. 27, 1917. The Workmen's Bureau did not send out this monograph with the aim to oppose Workmen's Insurance, but to help throw light on the German system, which many claim is almost perfect. It is in no hostile spirit that I call attention to this very severe criticism of the workings of the German Accident Insurance System which is made by Dr. Friedensburg, as a friend of the system.

Dr. Friedensburg says, "The system is a *circulus vitiosus*. Charity, pauperism and fraud are the segments of the circle, and to those who do not see in their countrymen a mere mass, it is a deeply painful experience that the insurance has directly led to a general alienation and demoralization."

The friends of compulsory Health Insurance claim that his criticisms were not generally shared and that these criticisms applied specially to the Accident Insurance system and not to the Health Insurance System in Germany. This last is true but the same workmen, employers, and officials were also concerned in the system of Health Insurance, and medical men can appreciate Dr. Friedensburg's reference to "one of the melancholy consequences of our Workmen's Insurance is *pension hysteria*." This monograph shows what many already know, what humans will do when the door is left open to get something for nothing, or for less than cost at others' expense.

The monograph is well worth reading.

G. E. WHITEHILL, M.D.

#### SOCIETY NOTICES.

WORCESTER DISTRICT MEDICAL SOCIETY.—The regular meeting will be held Wednesday, February 14, 1917, at 4.15 P.M. By invitation of Dr. James V. May, the meeting will be held at the Worcester Department of the Grafton State Hospital (Summer Street).

##### PROGRAM.

- I. A Demonstration of the Intravenous Salvarsan Treatment will be given in the operating room from 3.00 to 4.15 P.M. Some of the Laboratory Methods of Diagnosing Syphilis will also be shown.
- II. Paper by Dr. D. A. Thom: "Syphilis of the Nervous System and Its Treatment."
- III. Presentation of Cases by Drs. Hiram L. Horsman and D. A. Thom.

ERNEST L. HUNT, M.D., *Secretary*.

SUFFOLK DISTRICT MEDICAL SOCIETY.—A regular meeting of the Surgical Section will be held on Wednesday evening, February 14, 1917, at 8.15 P.M., at the Medical Library. The general subject of the evening will be Lung Surgery.

The Surgical Treatment of Bronchiectasis and Advanced Pulmonary Tuberculosis: Dr. Willy Meyer, Professor of Surgery in the New York Post Graduate Medical School and Hospital.

Discussion by:

Dr. Frederick T. Lord  
Dr. John B. Hawes  
Dr. G. M. Balboni  
Dr. George W. Holmes  
Dr. Samuel Robinson  
Dr. C. L. Scudder

W. J. MIXTER, M.D.,

CHARLES L. SCUDDER, M.D.,  
*Secretary*, *Chairman*.

NEW ENGLAND PEDIATRIC SOCIETY.—The forty-seventh meeting of the New England Pediatric Society will be held in the Boston Medical Library, Friday, February 23, 1917, at 8.15 P.M. The following papers will be read:

1. Certain Aspects of Epilepsy in Children, George Clymer, M.D., Boston.
2. Hemorrhagic Conditions, with Especial Reference to Purpura, George R. Minot, M.D., Boston. Discussion opened by Beth Vincent, M.D., Boston.
3. Iliac Adenitis and Abscess, Charles J. Mixter, M.D., Boston.
4. General discussion of Health Insurance. Light refreshments will be served after the meeting.

MAYNARD LADD, M.D., *President*.

RICHARD M. SMITH, M.D., *Secretary*.

#### NOTICE

BOSTON CITY HOSPITAL.—On and after Monday, February 12, 1917, the Out-Patient Department for Diseases of the Nervous System will be open daily from 9 to 11 A.M., instead of on Mondays, Wednesdays and Fridays as heretofore.

In view of the urgent need in our large cities for special clinics where patients with mental disease, who do not care to go to hospitals for the insane, may receive careful examination and expert advice and treatment, and in view also of the fact that the number of such patients who now come to the Out-Patient Department is steadily increasing, the physicians to the Department have decided that, for the present, Tuesdays and Saturdays shall be especially, although not exclusively, devoted to the examination of patients with mental disorder.

J. J. DOWLING, M.D.,  
*Superintendent*.